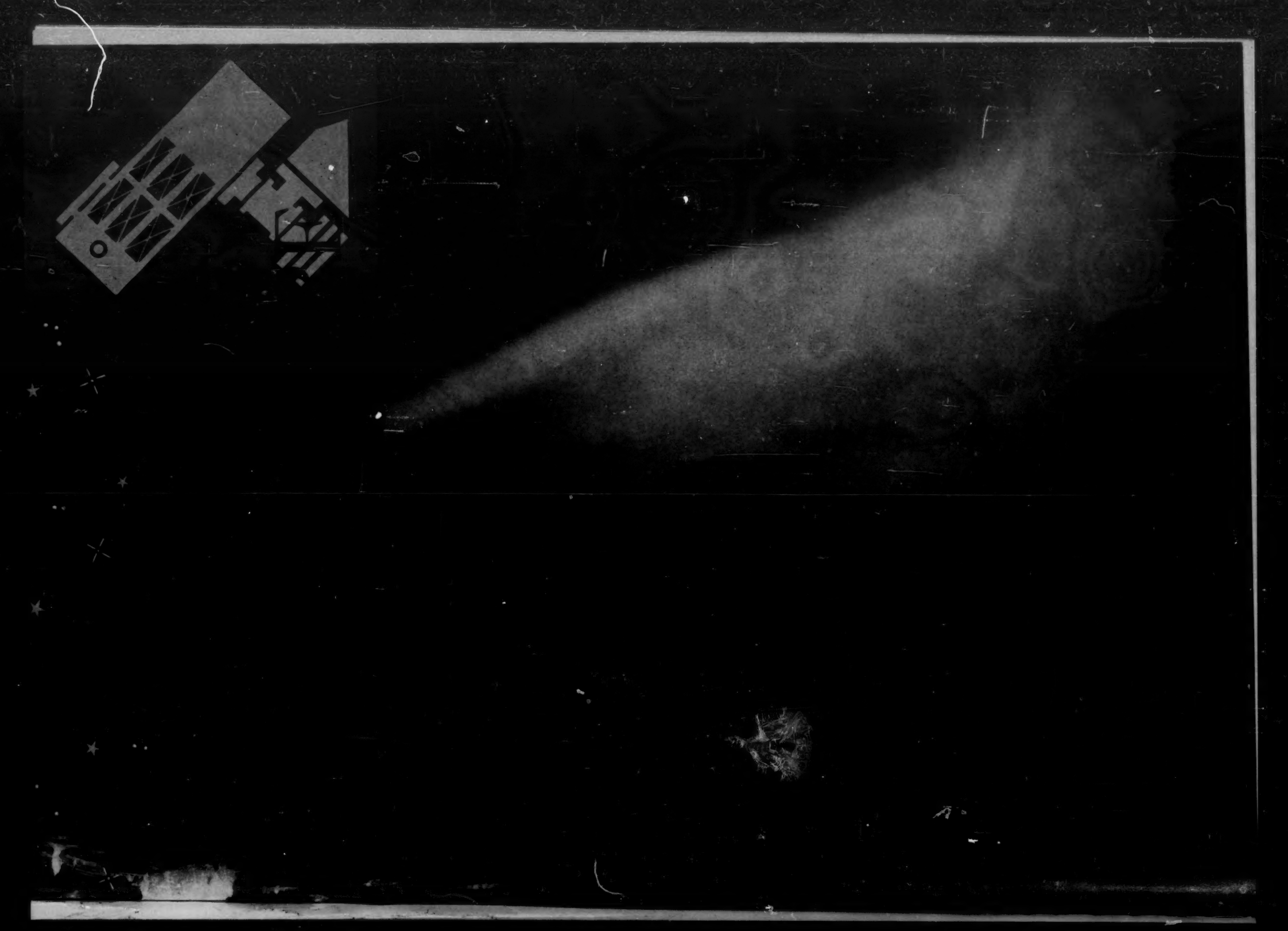

Sky and TELESCOPE

Charles A. Federer, Jr. . . . *Editor* Helen Spence Federer . . . *Managing Editor*

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The Editors Note . . .

ONCE again we start on a new venture. This time, however, it is really a synthesis of many existing projects and agencies. It is expected that **Sky and Telescope** will endure for many years to come, and play an important part in the development of the layman's interest in astronomy.

We wish to call attention to the pictures and letters on page 13. Scientists are still active abroad, in spite of the hardships which they must endure—they merit all the support we can give them.

We suggest that those who are not familiar with the beginnings of things, such as of **The Telescope** and The SKY, read the biographies on page 7. Those who missed the brilliant aurora in September may find some solace in the pictures on pages 14 and 15, and the front cover.

There certainly is no doubt that results are coming from the support scientists are giving the movement to educate the public in the difference between astronomy and astrology. The latest note appears in the November **Scientific American** in the form of an editorial by "Unk" Ingalls himself. Let all telescope makers sit up and take notice, and agree or disagree with him as they wish. As long as they read his remarks, they will be set thinking.

The educational process is given great impetus by such an unbiased discussion as Mr. Ingalls', although we cannot agree with him when he says "that, on the whole, there probably is little that can be done about astrology;" but we are glad that he has added his protest to those already made against the proposed series of motion picture shorts on astrology.

Amateurs and professionals alike should examine the proposed by-laws for the A. A. L. A., printed in full on page 20. Many amateur groups look forward to the organization of the League by the early part of 1942.

VOL. I, NO. 1 NOVEMBER, 1941

CONTENTS

COVER: The aurora of September 18th, 7:50 p.m. E.S.T., looking southwest, taken at Patchogue, L. I., by E. Dayton Thorne. See the picture by Fred Schmid on page 15 for the eastern end of this same band.

BACK COVER: The full moon, photographed with the Crossley 36-inch reflector at Lick Observatory. An article on the moon appears on page 17.

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LEONIDS AT LAVORIKA

By John A. Kingsbury

On the occasion of the Leonid meteor shower just 10 years ago, Dr. Kingsbury wrote this descriptive letter of the weekend observing party to his son, then a student at Phillips Academy, Andover, Mass. Three years later, John A. Kingsbury, Jr., was unfortunately killed in an automobile accident. A bronze plaque in his memory now stands near the Chapel on the Andover campus.

Dr. Olivier (*left*) and the author at Lavorika, November, 1931. Photo by Clyde Fisher.

THIS letter is in reply to yours of November 15th, although it will be devoted largely to an account of the Leonids observed at Lavorika; so in that respect at least, it should be addressed jointly to you and Jean. . . . We appreciated the keen interest of both of you in this star party, and your anxiety for its success. As you will soon see, there was reason for your anxiety, but your prayers prevailed. When the moment arrived for the real shower, all that was missing were our three beloved children—for Virginia had returned Sunday afternoon.

Mother went up Friday morning according to plan, and I drove Professor Olivier up in the LaSalle, arriving at Lavorika about 6:30. Doctor and Mrs. Clyde Fisher crept up the strange, dark mountain in their boiling new Pontiac about an hour later. Virginia and I had started out in the Chevy to find them when we saw their lights turning in at the Lavorika gate.

Soon we were gathered about the table in front of the big crackling fire, partaking of a veritable feast prepared by Arzula. We had decided to have no other guests that night, to retire early and arise a little before 2 a.m. so that we might make preliminary observations (weather permitting) from 2 to 4, at which time the earth was expected to enter the fringe of the Leonid stream.

Professor Olivier acted as the alarm clock for Dr. Fisher and me and, indeed, had one for himself. It was a typical November night. The air bit shrewdly, though it was not bitter cold. When I came out with all the woolens on my back I could assemble, and Dr. Fisher with only silk socks and an overcoat, we found Professor Olivier dressed like an Eskimo. That was the first lesson he taught us—learn to dress for meteor observation, especially in cold weather. Dr. Fisher was soon doing the tap dance to keep his feet from freezing, and by the end of an hour he was glad to accept Professor Olivier's suggestion that he should retire as we were only getting a few Leonids anyway. I stuck it out until 4 o'clock, but could not get warm the rest of the night. Altogether we saw 20 meteors, only six of which were Leonids. This, however, was enough to satisfy the Professor that by 1 o'clock Monday morning we would be entering a dense enough portion of the stream to give us a very respectable shower, and even for Sunday morning a good shower was promised.

Saturday was a perfect autumn morning in the Catskills, brilliant sunshine and crisp air. As you know, Dr. Fisher is an excellent photographer so he at once got out his big Graflex, mounted it on his tripod, and began taking pictures of the "astronomers" in the various poses in which he had observed them the night before. I insisted that I was only the secretary to the astronomer, but Professor Olivier insisted that I should be ranked with him. We had great fun taking the pictures, not only of the astronomers, but of the entire group, of the house and of the distant mountains. . . .

While the weather was yet favorable, we took the Fishers and Dr. Olivier on a sight-seeing trip around Woodstock. . . . After driving down Overlook Mountain, we returned home via Bearsville to find the clouds already enveloping our mountain, so thick, indeed, that I could scarcely see the road. It cleared a little later in the evening, but there was not a star in sight all night. Professor Olivier arose frequently to keep the watch. In fact, it was hardly necessary to arise for most of the time there was a veritable downpour of rain. Unhappily the Fishers had to leave in this downpour at 6 a.m. . . .

I drove over in the fog to Kingston to meet Professor and Mrs. Jan Schilt and their little girl, who arrived according to plan, on the day coach de luxe. Virginia accompanied me and took the next train to Yonkers so she could be ready for school on Monday morning. I am sorry now that we didn't let her miss two days of school in order to see the display which greeted our amazed eyes a little before midnight, Monday, the 16th. But, alas, the Schilts couldn't remain over Monday night, and Sunday night and early Monday morning we were still enveloped in the fog, as, indeed, we were all day Monday. . . .

As you may imagine, I had asked the other guests invited for Saturday and Sunday nights to postpone their coming until Monday night when I promised them a shower in any event, if not of stars, then of rain!

A number who had made their plans for the earlier nights were unable to come Monday so we didn't have a large crowd but quite large enough, although Mother had planned a bountiful midnight buffet for twice as many. This feast was spread on the kitchen table where guests helped themselves in relays all night long—the "Chis," the Schleichers, the Cramers, Mark and two or three others in addition to the astronomers and ourselves. . . .

We were all gathered about the fire, listening to Professor Olivier expound the mysteries of the meteors while the little

Two amateur observers made these sketches of the magnificent Leonid shower of 1833. The divergence point (now known as the *radiant*) was very marked. Prof. Denison Olmsted, of Yale, collected all observations he could, and prepared a paper for the *American Journal of Science*. This paper marks the beginning of meteoric astronomy.

house at Lavorika was enshrouded in mist. At about 11 o'clock, while the Professor was in the act of answering some awkward question, I believe it was "Chi" who pointed to the window, shouting, "A star!" We all rushed out of doors. The whole heavens were suddenly studded "with patines of bright gold." The moon, well into its first quarter, was shining through the trees in the west. The valleys below were still enshrouded in a grey mist. It appeared as though the curtain had been lifted for our special benefit. The performance was about to begin. Professor Olivier rushed into the house to don his Eskimo outfit. I followed him in search of my beret and big English cape. The whole hilltop about the house was a bustle of hurried preparations—the light and the records were laid out on the porch; benches from the pergola were brought; even the hammock from the porch was pressed into service on the improvised amphitheater facing Overlook and the Couch, where, above the horizon, already two stars of the Lion's head had appeared by the time our preparations were complete.

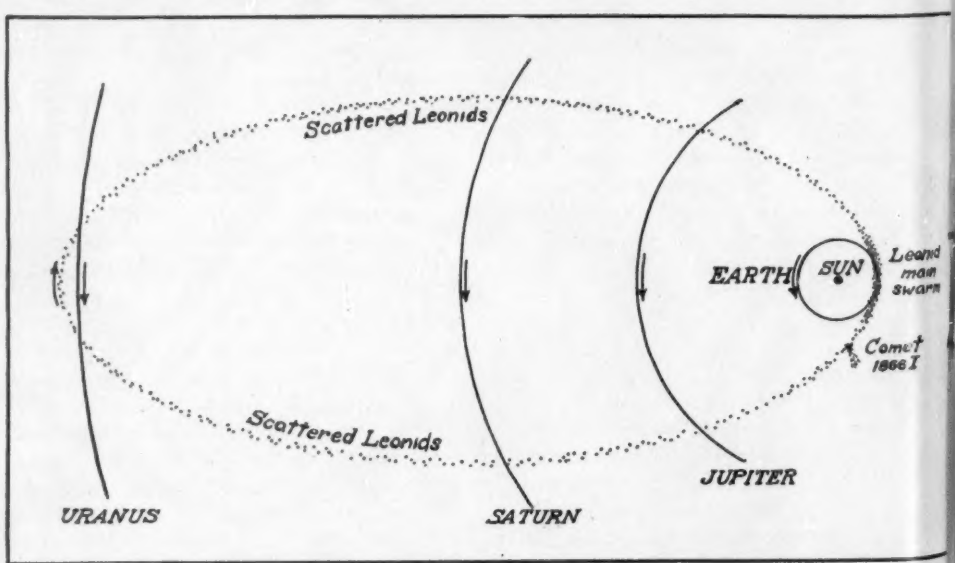
At about 11:30 the Great Producer began the prologue of his performance by sending a huge fireball out of the eastern horizon. It resembled a gigantic rocket starting on its trip to the moon, whither it proceeded in a magnificent arc almost completely across the sky, leaving a tail behind it much like the tail of a skyrocket, though not persisting long. Can you imagine the screams of excitement which went over this select little audience of observers? Professor Olivier was as tickled as a boy. He whispered in my ear, "Now we'll give them a real performance. That's a promise." Hardly had he those words out of his mouth when someone shouted "There's another!" And "There's another!"

In the meantime the Professor and I were preparing our records and warning observers to begin each the separate and accurate account of his own meteors. The observers were arranged according to the points of the compass, with several observers-at-large. They were cautioned as far as possible to keep in their own sector of the sky, and not to yield to the temptation to look behind them when somebody shouted "fireball."

Although this particular shower has its radiant in Leo, near the center of the "Sickle," the Leonids themselves frequently appear in all parts of the sky. They are distinguished from "strays" by projecting their course back to Leo. Professor Olivier does this by immediately thrusting a ruler up over his head in the direction where the meteor appeared, and quickly tracing the course back among the stars. I tried this for about half an hour, and tried plotting a few myself, but this was long enough to convince me that I am no expert. I soon found my niche in recording the observations of the rest of the party. The unit of count is the number of meteors seen per hour or per half hour per person. We decided to record them in half hour periods; so I ceased counting and prepared a record and took the counts of others, beginning at 12:30 Tuesday morning, the 17th, and every half hour thereafter.

The record speaks largely for itself. Blank spaces in the half hour periods give a fair idea, not only of who did the most consistent observing, but also who did the most consistent eating! This, however, does not apply to Mother. As you may imagine her blanks result from her work in preparing the eats. . . . The absence of my personal count I have just explained, although the total includes the sixteen I observed during the first half hour and also Professor Olivier's total. I do not have his half hourly record. I am sure you will be amazed that the total count of meteors observed amounted to 2,586! It must be borne in mind, however, that many of these are duplicates, for each person counted every meteor he saw, no matter who else saw it. Professor Olivier assures us, however, that this number probably represents less than the actual number that were visible from our "observatory," each person probably missing as many as he saw. Many, of course, are mere flashes; naturally no one missed the fireballs or the meteors of first and second magnitude. I know that you will be interested that Mrs. Chi had the record for the largest total—485—seen by one person, and also the largest number seen in any one half hour period—96. Mack was second with 319. They were two of the observers-at-large, and therefore would naturally see more than those who stayed in their own little corner of the sky. In this respect I think Cramer deserves the prize. His more than 300 were entirely in his own sector. Olivier observed to the south and recorded 265. Usually he missed at least one, and sometimes several while in the process of making his record.

That this was an extraordinary shower, and, I imagine, the most complete ob-

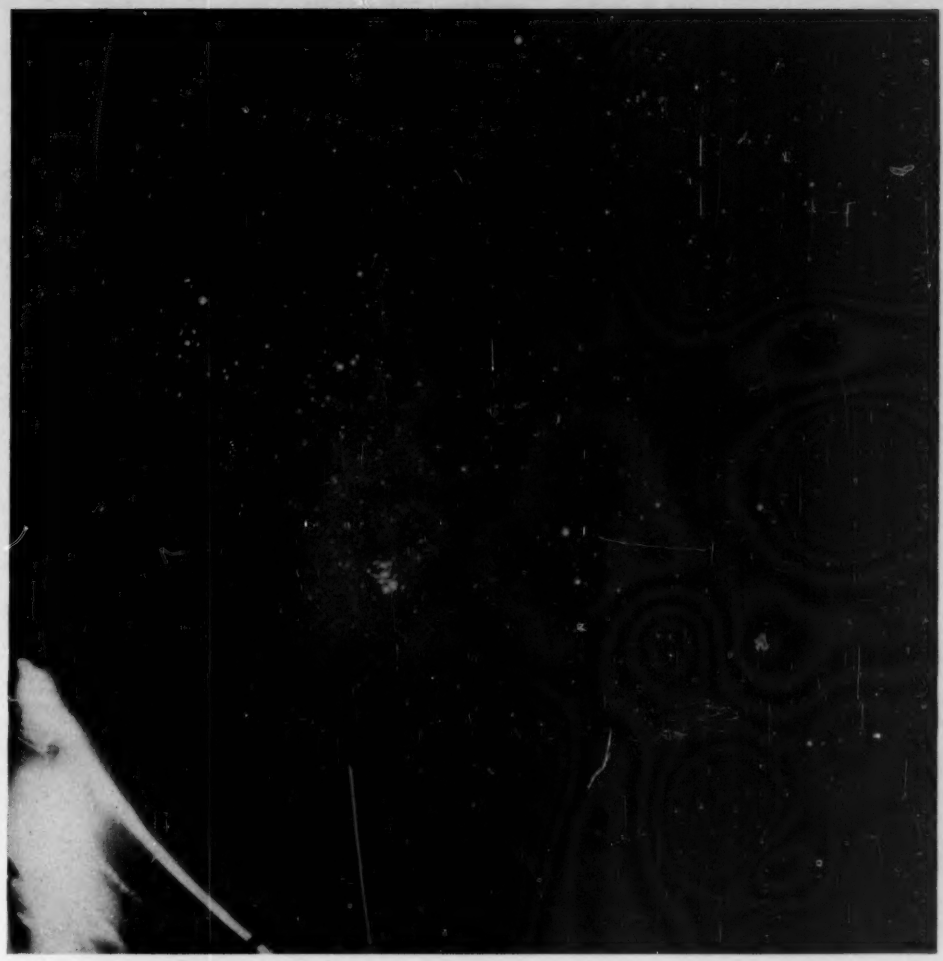


The orbit of the Leonids and of Tempel's comet were found by Schiaparelli to agree closely. This diagrammatic representation is not to scale.

servation, may be indicated by the fact that on the front page of the New York *Times* this morning there was a big story entitled, "Astronomers Study Meteors from Plane, Show of Leonids Greatest in Sixty-five Years." This observation was in charge of Dr. Paul W. Merrill of Mt. Wilson Observatory. The dramatic feature of it was that it was partly made from an airplane. The maximum count which they give, however, is much below that recorded by Olivier's party, although during one half hour they caught about the same number that Mrs. Chi recorded—in other words, about three a minute. The *Times* reporter called me a few minutes ago to interview me about the Leonids at Lavorika. I gave him the substance of what I have told you, but with the understanding that he would call Professor Olivier at the Flower Observatory at Philadelphia, to get the story from him, explaining, of course, that I was only one of the assistants. The reporter seemed greatly interested, and, I imagine, will print a good story.

Professor Olivier will publish a full account of this shower, which he says in many respects is the finest that he has seen during the thirty-three years he has been observing, in *Popular Astronomy* for December, which Jean, no doubt, will find in the current astronomical library at Swarthmore, and I rather imagine it comes to Andover as well.

There were many interesting incidents which I could add, but this account is already too long, and, moreover, Professor Olivier has most of the records. I don't remember how many fireballs we saw, but there must have been fifteen or twenty, which would easily classify as such. I remember definitely five I saw which left very striking trains . . . . the first shot directly at us from near Regulus, shot and apparently exploded, leaving a short but very fantastic train which persisted for about five minutes (Prof. Olivier has the exact time). This train crawled about under the influence of the wind at that high altitude (probably 40 miles!) until it took the form of a lizard. The train was not so brilliant, but it continually broadened itself out toward the head of the lizard and drew itself out into a long tenacious tail. Another fireball, which was not a Leonid, coming from the direction of the north star, left a train about fifteen degrees long, which took the form of a great corkscrew, broadening as it persisted for several minutes, and finally forming a long misty streak as it began to disappear. Another Leonid with a train which persisted for ten minutes was seen while I was in the house warming up and getting some lunch. The last fireball I saw was in the western sky shortly before daybreak. It was about ten degrees in length, shaped much like a snake crawling down the sky. One other, a little further to the south, was seen by all of us at about the same time. Its trail took the form of a huge fishhook, and the curve of the hook itself, not to mention the barb, must have been at least ten degrees in length, and the main part of the hook, I should say, was another ten or fifteen degrees in length. Again Professor Olivier will doubtless have exact measurements. This one was the prize for duration. I watched it with the field glasses for fifteen minutes, as it gradually broadened into a faint mist and finally disappeared. This was the finest, and the longest, train Professor Olivier had ever seen; in fact, he had never seen such fireballs and trains as he witnessed that night. . . .



This record of the zodiacal light was made with the camera on a polar axis, so the horizon is across the lower left corner, where streaks from automobile and other lights appear. Note the Pleiades (*center*) and the Hyades (*upper left*). Photograph by Donald H. Menzel at Lick Observatory, with f/3.5 lens of 8-inch focus.

As a grand finale of the evening, we all saw for the first time the zodiacal light, which Professor Olivier identified for us. By most of us it was naturally mistaken at first for the approach of dawn, but when it appeared, dawn was not yet due for another two hours. Mother was inclined to insist that it did indicate approaching dawn, and she was partly right in this for it is usually seen above the horizon along the zodiac at certain times of the year an hour or two before dawn, or after twilight. It resembles a bit a faint aurora. It at first takes the shape of a broad, and then a narrowing cone, the base resting on the horizon. In this case the point extended almost up to Leo, which by 4 a.m. was approaching the zenith. The base of the cone extended approximately from Mead's on Overlook to the foot of the Couch. I won't take the time, nor the risk, of explaining to you the cause of the zodiacal light. You may explain it to me after asking your respective professors!

As you will observe from the record, after 4:30 all our observers, save Mr. Cramer, dropped out, or perhaps I should say, "dropped in," around and about the fireplace, where they drank coffee, ate sandwiches and cake and kept up a constant buzzing of excitement, each telling the other what he or she had seen. . . . When the guests had left, Professor Olivier and I decided to lie down for a couple of hours. When I awoke we were again completely enveloped. I never have seen such a persistent nor hardly so dense a fog. I drove from Lavorika to Yonkers all the way with my bright lights on, and sometimes I feared that I would drop asleep before I got here.

So here endeth the tale of the first Leonid shower observed at Lavorika. It is too long, but I am sure you have been interested in the details, and I thought I would write them out while they were yet fresh in my mind.

ASTRONOMICAL ANECDOTES

THE "MOST COMETARY YEAR" AND HANDICAPPED ASTRONOMERS

THE discovery of Comet van Biesbroeck 1925j has some interesting ramifications. At the meeting of the British Astronomical Association on October 28, 1925, the late Dr. A. C. D. Crommelin, then director of the Cometary Section, reported on the current comets in these words: "This has been an active year in the comet world; we are assured of nine perihelion passages this year; 1898 is the record year with 10. I would ask the members of the Comet Section to do their best to add two more, so as to break this record. . . ." The president, the Rev. C. D. P. Davies, said in closing the meeting, "We are grateful to Dr. Crommelin, and we tender our best wishes that he may get his two extra comets."

At the meeting of November 25th that year, Dr. Crommelin rose to say this: "At the last meeting, I made a statement about the comets of 1925, appealing to our members to look for comets, since for perihelion passages we were just one below the record year of 1898, and I asked them to find two more comets. Of course it is one thing to look for comets and another thing to find them. You will remember the analogous passage in *Henry IV* where Owen Glendower says: 'I can call spirits from the vasty deep'; and Hotspur replies: 'Well, so can I, and so can any man. But will they come?' But in our case the comets have been most obliging, and have come; and this is the most cometary year on record. It now has 11 perihelia." In addition to van Biesbroeck's discovery, Peltier and Wilk had found one, in mid-November.

But before a month was out, Crommelin was disappointed to find that the number of perihelia was reduced to 10, for Comet Wolf was nearest the sun on December 30, 1924, and not early in January, 1925. Ensor discovered a comet in December, 1925, but its perihelion fell in 1926. But Crommelin's triumph came much later. There was discovered at Bergedorf on November 15, 1927, the strange Schwassmann-Wachmann comet, with a nearly circular orbit, lying between those of Jupiter and Saturn. Its perihelion had occurred in the spring of 1925, so that year remains the "most cometary year" on record, with 11 perihelia. There have been years when more comets were discovered, but a comet belongs to the year, nearest to the time of discovery, in which it reaches perihelion.

In passing, we might consider it somewhat interesting that Crommelin, Merton, and many others well uphold the share of the British Isles in matters cometary, yet there has not been a comet discovered there for about 50 years! It seems strange that with so many professional observatories and perhaps the most active group of amateurs in the world, there should not have been found at least one comet in more than a generation.

In the October SKY, the silly falsehood that Pons, the comet discoverer, who started his astronomical career as janitor of the Observatory of Marseilles, was blind from birth was mentioned, and it has recalled the fact that there have been infirmities among astronomers. One of the first announcements of the much-discovered Comet Jurlof-Achmarof-Hassel-Smith-etc., not so long ago, came from Oslo. On April 16, 1939, a Norwegian amateur, named Hassel, set his telescope on the field of the variable star R Trianguli, preparatory to estimating its magnitude. Imagine his surprise to find, intruding in the field, the tail of a comet!

Hassel was born in central Norway in 1898; he was deaf and practically mute. He attended a school for deaf-mutes, and proved to be exceptionally apt in his studies, but he went back home to assist his parents on the farm. He read prodigiously in astronomy, and made a telescope from spectacle lenses; in 1926, however, he bought an astronomical telescope, and he uses it to observe variable stars. He is also a cooperating observer in the important Norwegian projects of photography and study of the aurora.

In 1669, Montanari of Bologna observed a change of a magnitude in the brightness of Algol. Practically no attention was paid to this phenomenon for a century following, until two young Englishmen, Edward Pigott and John Goodricke, formed a friendship over matters astronomical. Pigott discovered the Cepheid variable Eta Aquilae, and the interesting erratic variables R Coronae Borealis and R Scuti. But Goodricke discovered Delta Cephei and Beta Lyrae, and returned attention to Algol. At the age of 19, he was awarded the Copley medal, the highest award of the Royal Society, for saying this: "If it were not too early to hazard even a conjecture on the cause of this variation, I should imagine it could hardly be accounted for otherwise than either by the interposition of a large body revolving around Algol, or some kind of motion of its own, by which part of its body, covered with spots or such like matter, is periodically turned toward the earth." That his first idea was the correct one was verified by Vogel from spectroscopic observations made in 1889, a century and three years after Goodricke died of exposure suffered during variable-star observations.

Like Horrox, the young English divine who died at the early age of 22, Goodricke, who died at 21, would probably have been a most outstanding figure in astronomy, had he lived. Possibly his deafness and muteness assisted him in his concentration, so that he could in such a short while have determined the period of Algol as "about 2 days and nearly 20¾ hours," and suggested the correct interpretation of the phenomenon.

R. K. M.

Hassel was a co-discoverer of Comet 1939d, officially designated as Comet Jurlof-Achmarof-Hassel. The photograph at the left was taken at Oslo, April 21, 1939; the second picture was made at the Oak Ridge station of Harvard on the 23rd.

BIOGRAPHY

The Telescope

THE first issue of a small quarterly magazine called *The Telescope* appeared in March, 1931. Dr. Harlan T. Stetson, then director of Perkins Observatory of Ohio Wesleyan University, Delaware, Ohio, thought that a popular magazine might be of value to astronomy in general. In addition, he hoped that it would keep the world informed of progress in astronomy at the Perkins Observatory.

When *The Telescope* was born, the 69-inch mirror of that observatory was slowly nearing completion at the optical shop of J. W. Fecker and Company, at Pittsburgh. For a time, astronomers at Perkins carried on astronomical work with a 60-inch mirror borrowed from Harvard Observatory. The completed telescope went into opeation in the summer of 1932, bringing to Ohio the largest telescope east of the Rocky Mountains and, then, the third largest in the world. The later completion of the McDonald Observatory, in Texas, with its 82-inch mirror, has caused the Perkins reflector to drop back one place in the instrument roster.

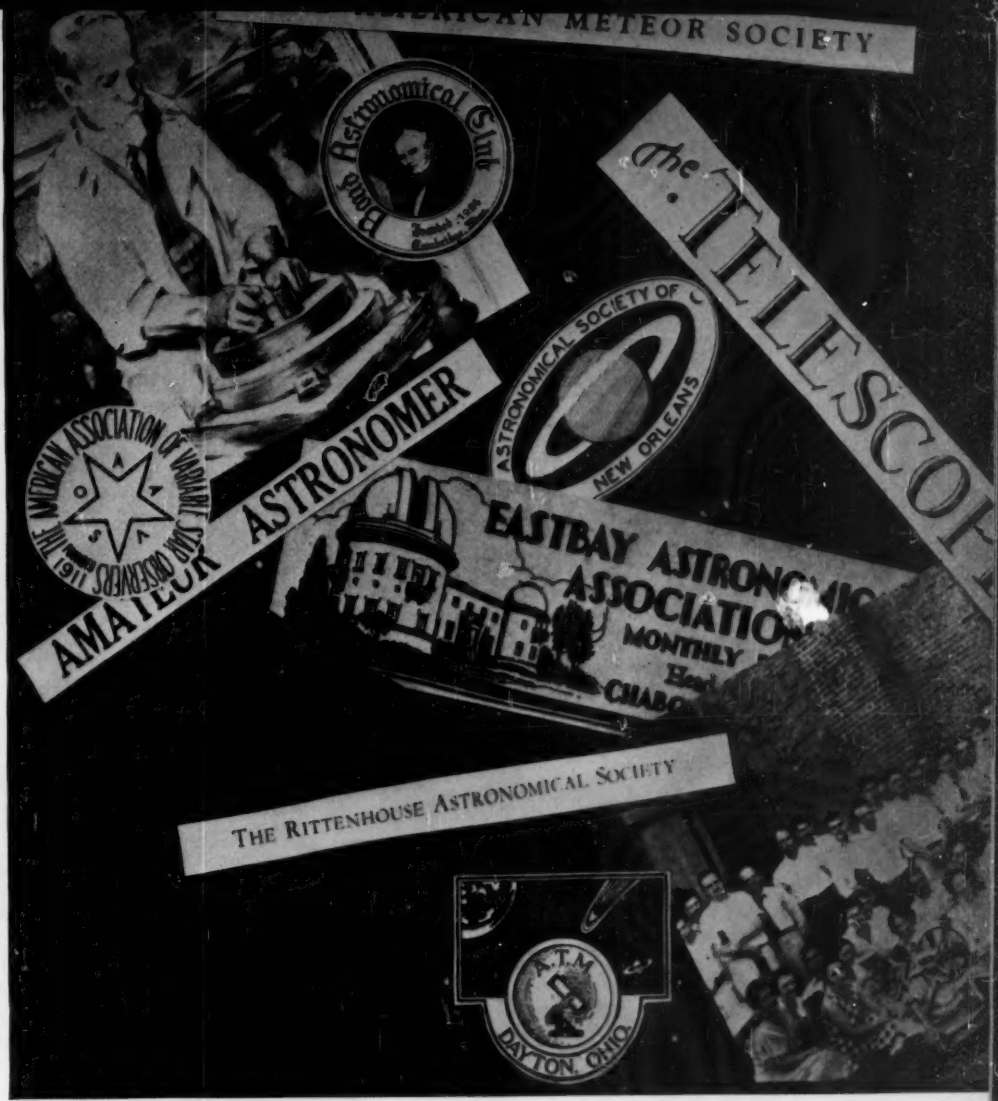
With the issue of July, 1933, *The Telescope* started as a bi-monthly magazine with a larger-sized format. The demand of its readers for more well-illustrated material on astronomy led to the enlargement and change of form.

When Dr. Stetson, who continued as editor of the enlarged *Telescope* for three of its issues, came to the Massachusetts Institute of Technology, he invited the Bond Astronomical Club and Harvard Observatory to take over the sponsorship of the magazine. Thus, in June, 1934, under the editorship of Dr. Loring B. Andrews, was begun the publication of *The Telescope* from Cambridge. When Dr. Andrews left for England in 1937 to study problems of radio broadcasting, I succeeded him as editor.

The Telescope, during the 10 years of its existence, has carried many news stories of important astronomical discoveries, reviews of work in numerous fields of astronomy and allied sciences, and occasional articles of historical nature. Many of its articles have received recognition and have been commented upon by workers in outside fields.

May I thank everyone, readers, authors, assistants, and collaborators alike, whose generous support of *The Telescope* has made possible its continued existence. I will continue to work with the editors and advisory board of *Sky and Telescope,* with the hope that the combined publication will be of increased usefulness to every astronomer, from the amateur sky-gazer to the profound professional.

DONALD H. MENZEL



This interesting illustration appeared on the front cover of *The Telescope* in 1935. It reveals the extent of amateur activity before the advent of The SKY, but when the *Amateur Astronomer, The Telescope,* and other publications of a similar nature were already well-established.

The SKY

IN April, 1929, the Amateur Astronomers Association, with headquarters in the American Museum of Natural History in New York City, issued the first number of its magazine, *Amateur Astronomer.* This took the form of a small, four-page printed bulletin containing short articles of astronomical interest, reviews of lectures given under the auspices of the A.A.A., star charts, and general review of the heavens for the current month. The editor, Dr. Clement S. Brainin, announced in the first issue that 10 numbers would be printed each year, none in July and August. M. Louise Rieker, first secretary of the A.A.A., and assistant editor of the magazine, had much to do with the planning and beginnings of the *Amateur Astronomer.*

By then secretary of the A.A.A., the author took over the duties of assistant editor in the autumn of 1930.

The first number of Volume VI, Winter 1933-34, marked a change in the magazine from a printed four-page sheet, to a larger quarterly, produced by photo-offset process. The publication continued in this form through Volume VIII, No. 3, Spring 1936.

In the meantime, there appeared in November, 1935, an attractive magazine, the *Monthly Bulletin* of the Hayden Planetarium, presenting The Drama of the Skies, and edited by Hans Christian Adamson. The *Bulletin* ran usually to about 20 pages, and contained each month a review of the current show being presented in the Planetarium as well as other astronomical items and articles.

In the October, 1936, issue of the *Bulletin,* the following statement was made by the editor: "The response the *Bulletin* has received during its first journey around its orbit of the calendar year has been so encouraging that the magazine, beginning with the November issue, will enlarge not only its scope but also its size. At the same time, the magazine also changes its name to The SKY. . . .

"The SKY welcomes the editorial participation of the Amateur Astronomers Association and the Junior Astronomy Club. Miss Dorothy A. Bennett, representing the Junior Astronomy Club, and Miss Marian Lockwood, representing the

(*Continued on page* 26)

Is Mars Inhabited?

The age-old question, which may never be answered, is discussed here and in the Hayden Planetarium show this month. Mars still shines brilliantly in the November evening skies.

Mars, longitude 270°, from a globe of the planet at Lowell Observatory.

MYSTERIOUS MARS

By William H. Barton, Jr.

THE question is frequently asked, "Do astronomers believe Mars is inhabited?" or more bluntly, "Is Mars inhabited?" Those two questions are far from the same. One involves speculation, the other merely facts. Let's examine the latter first. What facts do we really have about Mars?

In The SKY last month we spoke of the planet's size and distance. Through even a moderate-sized telescope the red disk is mottled with darker markings and whitish spots can be seen at the poles. With more powerful instruments under ideal seeing conditions experienced observers can detect a great many more details, and some of them can be photographed. For the study of these delicate markings visual observations exceed photographic.

A telescope of 25- or 30-foot focus will make an image of Mars, when the planet is nearest to us, about four hundredths of an inch in diameter—smaller than the size of the inside of an "o" in this type face. The grain of the photographic plate, fine as it is, cannot record too much detail in such a small image. Generally pictures of this kind are not snapshots, but time exposures. Irregularities in following the planet with the telescope, shifting of the image due to inequalities in our atmosphere, tend to blur the sharpness of the picture. But all our knowledge of this neighbor is not gained by photography or visual studies through the telescope. We know something of the temperature and of the character of the Martian atmosphere.

In all the years since 1877, when the "canals" were first noted, one might think that so many observations would have been gathered that there would be nothing more to do. Not so, because actually time is limited. Mars comes to opposition, when for a few months it is favorably placed for study, once every two years and two months, approximately. Since the Martian day is about 37 minutes longer than ours, each night's observation finds the face of Mars advanced a little and in a month's time a whole new hemisphere is turned toward us. That is, any particular spot on the planet is in good observing position for only 10 days or two weeks, during which time there may be but a few nights of "good seeing." The oppositions are not all equally favorable. The distance varies greatly and only at 15-year intervals do we have "best" oppositions. Therefore we cannot expect our knowledge to advance by leaps and bounds—but only by tiny steps and creepings.

A composite picture of Mars in infrared (*left*) and ultraviolet light, taken at the Lick Observatory. Note that the planet appears larger in the right half—the atmosphere has not been penetrated.

In E. C. Slipher's photographs made in Africa at the 1939 opposition of Mars, the polar caps present interesting phenomena. It was spring on Mars' southern hemisphere—about April and May in the northern hemisphere of the earth. The southern polar cap began melting, or disappearing, perhaps we had better call it, and displaying the same rifts and markings that had been seen for many years. When photographs were made through various color filters there seemed to be two superposed caps, so to speak. One, visible when a blue filter was used, disappeared with the red, indicating penetration as though through a cloud or haze. Mr. Slipher interprets the polar cap as a cloud of ice crystals. Cirrus clouds in our own atmosphere are made of ice crystals, too.

Various surface markings, visible best through a red filter, showed color changes that are more difficult to explain. Some canals showed more plainly than in previous studies, others dimmer. And what is more, these reversals would occur in the same locality. This appears to rule out mere atmospheric changes, in which case

a whole region should be brighter or dimmer at the same time. These rhythmic changes offer a challenge to the observer.

The atmosphere of Mars is relatively clear or we could not see the planet's surface as plainly as we do—better, in fact, than any other planet.

Venus may approach 10 million miles closer than Mars, but when it is nearest we cannot see it. The dark side is toward us and it is in the bright glare of the sun. But when Mars is nearest, we see its sunlit side and it crosses our meridian (therefore at its greatest altitude) near midnight. Water vapor may form the clouds that are seen on Mars, but it is doubtful that there is any open water. Water is believed to be a very scarce article on the planet. The water vapor in the atmosphere is so scant that the most delicate tests show scarcely any.

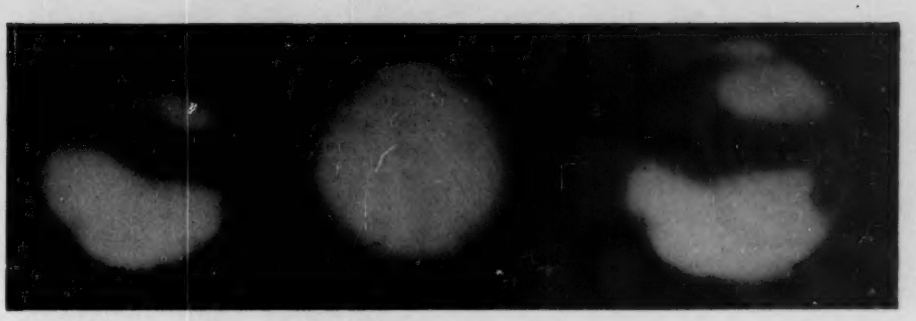
Attempts to detect oxygen in the Martian atmosphere have met only failure. It is believed that if it is there, it is less than one third as dense as in our own. The ruddy color of Mars may indicate oxygen combined in the rocks—fossil oxygen. Perhaps weathering has imprisoned the free oxygen as oxides, similar to our familiar red iron ore. Carbon dioxide has not been found either, but that element would be seen only when present in relatively large percentages. This does not present a particularly favorable picture for life. But it is possible that some primitive forms might exist even under these conditions.

The temperatures have been found to be rather low, even at noon. In the tropical zones on Mars the temperature goes above freezing, perhaps to 50° F. or higher. The polar regions in winter drop to about 125° F. below zero, while the summer temperature on the polar cap goes above zero. As the sun drops in the Martian sky in the afternoons the temperature falls rapidly, since the thin atmosphere does not retain the heat well. Here on the earth, on high mountains where the air is thin, we find a similar condition. At night on Mars even the tropics have "cool" nights, about 130° F. below zero.

These are the facts that have been gathered over the years. Upon them we must base our speculations about life on the planet. What conditions do we lay down as necessary to life? And when we say "life," will we be content to find plant life, or do we insist upon animals, and need they be intelligent beings?

In the first place, the planet must have an atmosphere that can support combustion. Of course, we are thinking of life that at least in the major aspects resembles life on the earth, not some weird strange creature that operates on a principle far removed from oxidation.

We know that Mars has an atmosphere that is very thin, but we also recall that earth people can become adapted to live in high altitudes where the air is rare.



MARS—JULY 21, 1939

in orange light	in blue light	in orange light
6h 8m U. T., 229°	6h 12m U. T.	7h 10m U. T., 245°

Mars is generally considered a difficult object for amateurs to photograph, but these pictures show that some details of the Martian disk can be recorded. They were taken by Latimer J. Wilson, Nashville, Tenn., with his home-made 12-inch reflector, of 96 inches focal length, using a 1-inch achromatic eyepiece arranged in the form of a rapid rectilinear lens. The original images are here enlarged about 12 times.

The low oxygen content is, of course, a handicap, but again adaptation might well make it possible to live with little oxygen. There seems to be a fair indication of water vapor's presence on Mars. Even animals might become fitted for such atmospheric conditions, and plants could certainly fit themselves into that picture.

Plants mean food for animals. Therefore, if animals could bring themselves into tune with this kind of world they might well find food and water. There still seems to be indication that the polar cap behaves as our own polar cap, building up in winter and shrinking in summer, with a blanket of atmospheric haze advancing and receding in a somewhat parallel manner.

The temperature on the ruddy planet is low, extremely low as compared to earth temperatures. But again, here on the earth we find animal life living under the most inauspicious circumstances. How far our organisms can be forced to meet conditions we dare not say, but we can assume that we are rather elastic.

What would Martians be like? Unfortunately (or fortunately?) we have never seen them. Or did you see some on that memorable Sunday night of October 30, 1938, when they poured in on us along a radio channel (and I mean channel, not canal)?

The low oxygen supply would make for Martians with large lungs and hearts. To conserve moisture their skins would not breathe as ours do (dogs have such skins). Martians would be larger than we are to accommodate this enlarged breathing apparatus, but they would not feel that as a handicap. The surface gravity on Mars is only 0.38 that on the earth. That is, they might be two and one half times as massive as we are, yet would weigh no more. Or if the Martians were smaller and lighter than this limit, they would move around with more expedition and with a saving of fuel. And with their scant supply of everything, they no doubt hear a great deal from the Martian high command about saving.

If this picture is not too far-fetched—and it is only speculation—it presents the Martians fighting a losing game. The planet may be a dying world—oxygen fixed in the surface. It is a globe so small that it can hold only the scantiest atmosphere. Water is apparently at a premium. Low temperatures prevail. And perhaps the Martians fight for their lives; hardly could they build "canals." But speaking of "canals" on Mars was a mistake in the beginning—a misinterpretation.

We just do not know much about life on Mars.

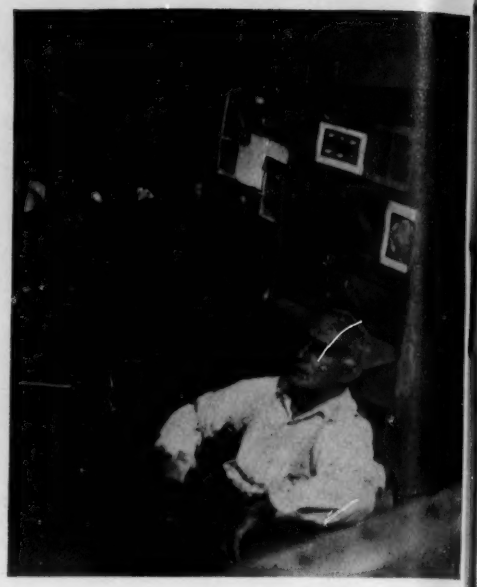
Friends of Mine

The stars are friends of mine. To lofty height,
When falls the sombre canopy of night
Upon a slumb'ring world, my spirit flies
And treads with them the highway of the skies.
We stride from world to world, while they rehearse
The mighty chorus of the universe.
We wander into fields of azure blue
Sprinkled with diamonds of varied hue,
Seek the lost Pleiad through skies aflame,
And learn from her the secret of her shame.
They mark the ways of men and shake with mirth
At all the customs of this lowly Earth.
Great wisdom and great mysteries they know.
They tell the story of the Long Ago
Ere Time was born, when Chaos had its sway,
And Darkness held its mantle over Day.
Why should I prize the boasted things of Earth
When I can walk with stars and share their mirth,
Their wisdom and their mysteries divine?
I'd rather walk with stars. They're friends of mine.

RICHARD HERBERT MANN

30th Annual Meeting of A.A.V.S.O.

By Percy W. Witherell



A total of 65,000 observations of variables has been made by these amateurs. Rev. Bouton (*left*) is from St. Petersburg; Mr. Jones (*right*), from Goffstown, N. H.

"TO achieve perpetual youth, join the American Association of Variable Star Observers," might be the motto of that organization, for the Rev. T. C. H. Bouton, although 85 years of age, continues to add to his 25,000 observations after 30 years of activity; E. H. Jones, 78 years young, has sent in 40,000 since 1923; J. M. Baldwin, of Australia, 35,000; and R. G. Chandra, in India, 29,000, since 1920. Leon Campbell has made 50,000 personal observations and has discussed and prepared graphs including nearly a million observations since 1900.

This devotion to duty is being emulated by the younger set also. L. C. Peltier has discovered, independently, half a dozen comets and several novae, and has made 60,000 variable-star observations since 1918. Cyrus F. Fernald holds the record for the past year with 3,133 looks at these changing stars to his credit.

The following members of the A.A.V.S.O. show 10 years of faithful service: Anhert, Bappu, Brocchi, Buckstaff, Cilley, Ensor, Ford, Hildom, Houghton, Houston, Kanda, Meek, Millard, Monnig, deRoy.

This proof of the alertness of the Association was disclosed by the recorder at the 30th annual meeting of the A.A.V.S.O. which was held at the Harvard College Observatory in Cambridge, Mass., on October 10-11, 1941.

On Friday evening the Association attended the meeting of the Bond Astronomical Club and enjoyed a symposium on the methods of observations of variable stars. Mr. Campbell explained the visual method of making observations and the process of recording and translating the results into a graph, like the one of SS Cygni on display at the Observatory. The chart is 70 feet in length and shows 56,000 observations covering the past 45 years.

Miss Henrietta H. Swope discussed the photographic method of superposition of positives and negatives of the same field and the convenience of the examination of past exposures, especially useful in the detection of very faint variables.

Mrs. Margaret Mayall showed the method of Dr. Annie J. Cannon in detecting variables on spectral plates, and impressed everyone with the amazing skill of our late beloved associate.

Dr. Cecilia Payne-Gaposchkin told how apparently unrelated data in different fields are skillfully integrated into a consistent picture, and suggested some of the problems that the future may successfully solve.

Many members gazed through the 15-inch refractor and were rewarded by seeing some distinct markings on Mars, which was in opposition to the sun and approximately at the nearest point to the earth.

On Saturday, Dr. Dirk Brouwer announced that the British Nautical Almanac would not publish the reduction elements for 1942, but would send them to Yale, and in 1943 would not compute these elements, but would make its own reductions. Reports from the occultation, nova-search, chart, and aurora committees were presented. Photographs of the aurora of September 18th were exhibited by Edward A. Halbach, of Milwaukee, and Kurt W. Opperman, while the Rev. William M. Kearons showed a remarkable series of sunspot photographs taken at that time.

A detailed report of many years' observation of U Carinae was sent in by A. W. J. Cousins, of South Africa. He showed that this star is subject to variations in the period of its light changes.

Making one's own light curves is interesting work—and a valuable pastime for cloudy and rainy nights! His own technique, and some of his results, were discussed by Dr. W. L. Holt, of Scarboro, Me. He suggested that beginners at this work start with circumpolar stars, so they would not run into too long gaps in the reports.

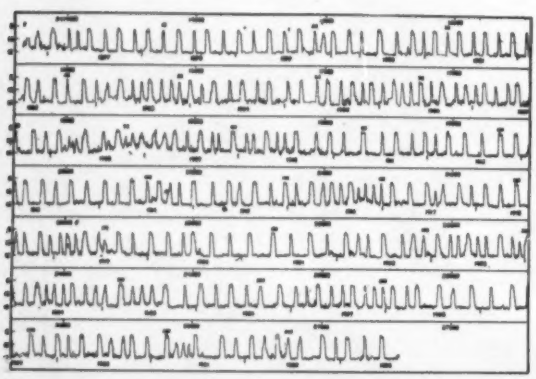
Miss Marjorie Williams, of Smith College Observatory, gave the results of her work with Miss Margaret Harwood, director of the Maria Mitchell Observatory at Nantucket, on the distances of the Cepheid variables in the Scutum cloud.

It was announced that the new "skipper" (president) of the Association would be Dr. Brouwer, assisted by Roy A. Seely and Mr. Halbach as mates, while the Three Musketeers, Mr. Campbell, D. W. Rosebrugh, and Percy W. Witherell, as recorder, secretary, and treasurer, respectively, would continue to help in the navigation of the good ship *A.A.V.S.O.*

At the close of the morning session, the Association adjourned to the Residence and enjoyed a buffet luncheon as the guests of Dr. and Mrs. Harlow Shapley.

In the afternoon, the Milton Academy was visited, and W. B. Stearns, its principal patron, and Dr. A. E. Navez, its director, explained the interest of the Milton boys in the field of astronomy, and how work at the Academy correlated physics, chemistry, mathematics, navigation, and biology.

Dr. C. W. Gartlein, of Cornell Univer-



Light curve of SS Cygni, 1896-1933. With observations up to the present, the light curve made an interesting exhibit at the meeting. Note the irregular, yet partially periodic, character of the light changes.

sity, showed a large number of pictures of aurorae, especially of the recent brilliant display, and explained the importance of accurate data from observers, if such were to be used in calculating the geomagnetic pole and the extent of the phenomenon. (See pages 14, 15, 16 of this issue.)

At the annual dinner in the evening, the new president, Dr. Brouwer, called upon Charles A. Federer, Jr., who gave an interesting talk on the proposed Amateur Astronomers League of America.

After Mr. Rosebrugh had read verses of appreciation, the greetings of the Association were wired to our retiring president, Dr. Helen Sawyer Hogg, in Canada.

Dr. Shapley summarized some of the highlights of the past year in astronomy:

(1) The determination of a more accurate solar parallax by the Astronomer Royal of England, Dr. H. Spencer Jones, from observations of the 1931 opposition of Eros. The revised parallax is 8".7900 ± 0.0008—corresponding closely to 93 million miles. (See Dr. Whipple's article, below.)

(2) Dr. Bengt Edlén's proof of the presence of ionized iron, calcium, and nickel in the solar corona, and especially of Fe XIV, showing the loss of 13 electrons. This indicates a temperature in excess of 1,000,000° C., according to Dr. Edlén and Dr. Donald H. Menzel.

(3) From his two-mile high station in Colorado, and using the Harvard coronagraph, Walter O. Roberts had just telegraphed the good news that he had succeeded in obtaining photographs and spectra of the corona.

(4) Dr. Martin Schwarzschild has extended the pulsation theory of variable stars and applied it to the cluster-type Cepheids, and R. M. Scott, of Harvard, has been able to interpret long-period variables in terms of the pulsation theory.

Observatory buildings of Harvard College, at Cambridge, Mass., scene of the A.A.V.S.O. meeting each fall (and new home of *Sky and Telescope*).

(5) Dr. Shapley then spoke of the card catalogue of variables which stands as a monument to Dr. Cannon, and showed the first volume of the bibliography of variables discovered from 1931 to 1938, compiled by Dr. Richard Prager and published by the Harvard College Observatory.

(6) Dr. R. Minkowski, of Mt. Wilson, has shown that the spectra of supernovae can be interpreted without the assumption of an excessively high temperature. He recognizes many lines that appear in the spectra of ordinary novae; indeed, the two are very similar, apart from the widening produced by the high velocity of the gases. His conclusions thus tend to confirm some earlier results of Dr. Payne-Gaposchkin and Dr. Fred. L. Whipple, who developed "synthetic" theoretical spectra for these objects.

After seeing colored motion pictures of the 1940 meeting at Oak Ridge taken by Lewis J. Boss, everyone enjoyed a musical skit on the vagaries of theoretical and observational astrophysicists that concluded the evening, and agreed upon "the ideal happiness of being an (A.A.) V.S.O."

HOW DISTANT IS THE SUN?

SINCE 1931, when the asteroid Eros came within 16,200,000 miles of the earth, astronomers have waited and waited and waited to learn the new value of the sun's mean distance. Before the close approach, elaborate preparations were made for the photographic observations. Stars along the predicted path were reobserved for position at several observatories, while special cameras were devised and made ready to photograph Eros. Many observatories over the whole earth cooperated in the entire program of preparation and observation. The Eros program is indeed a fine example of international cooperation in astronomy.

At the time of the close approach, a huge number of photographs of the asteroid were made, particularly in the early evenings and mornings, when the observing stations were near the edge of the earth, as seen from Eros. In late January, 1931, the earth's disk was over 100 seconds of arc in diameter for a hypothetical observer on Eros. Thus for terrestrial observers the rotation of the earth from evening to morning changed the apparent direction of the asteroid by most of an 18th of the moon's apparent diameter. Eros, of course, was moving across the sky during the observations, but the allowance for this motion was a part of the great task of reduction.

The essential problem was to measure an angle of somewhat less than 100 seconds as accurately as possible, in order to determine the distance of Eros by triangulation. This distance would be in miles because the positions of the various observatories on the earth are accurately known. A subsequent step in the problem was the calculation by celestial mechanics and orbit theory of the varying distance of Eros from the earth, in terms of the astronomical unit, or the mean distance of the earth from the sun. Comparisons of the distances determined in miles with those in astronomical units specify the length of the important astronomical unit in miles.

The Astronomer Royal of England, Dr. H. Spencer Jones, was assigned the enormous task of the reducing, analyzing, and coordinating of the observations of Eros by the various observatories. The most recently received number of *The Observatory* (August, 1941), presents Dr. Jones' results, as given at the June and July meetings of the Royal Astronomical Society. Dr. Jones explains that "Ten years may seem a long time for the completion of the reduction of these observations, but it must be remembered that a number of observatories took part in this programme and that the material had to be coordinated in successive stages. The pace was, in consequence, regulated by that of the slowest participant. . . ."

The Astronomer Royal's result is given in terms of the solar parallax, the radius of the earth as seen from the sun. His new value is 8".7900 ± 0".0008, corresponding to a mean distance from the earth to the sun of 93,003,000 miles, with the exceedingly small probable error of only 8,000

miles. Because, by the laws of probability, there is a 50 per cent chance that the actual error may exceed the probable error, we may remember the new value of the sun's distance simply as 93,000,000 miles.

This new value of the astronomical unit is more than 100,000 miles greater than the generally accepted value. Since we have considered the older value to have a probable error of only 20,000 miles or less, the substantial change in this fundamental constant comes as somewhat of a shock to the astronomer. Dr. Jones discusses this discrepancy and is unable to find a possible source of observational error sufficiently large to remove the difficulty. The new result has been obtained with such painstaking care from such a tremendous quantity of the best observational material, and the internal agreement from the various observatories and from the right ascension and declination determinations separately is so excellent, that we must accept the new determination as the most accurate to date.

It must be pointed out, however, that the observations of Eros in 1931 can also be analyzed to determine the gravitational attractions, or the perturbations, of the earth and moon upon Eros at the close approach. These attractions will then give a new measure of the ratio of the mass of the earth to that of the sun and lead eventually to a gravitational determination of the sun's distance. This gravitational method should be even more accurate than the geometrical method used by Dr. Jones. Hence the astronomical world may not adopt the new value of the sun's distance as final until the extremely laborious calculations by the gravitational method have been executed.

The work of Dr. H. Spencer Jones, nevertheless, is of such great value that it stands as one of the two or three major contributions to positional astronomy of the past decade.

FRED L. WHIPPLE

BUHL CONDUCTS SURVEY ON ASTROLOGY

A survey of public opinion conducted by the Buhl Planetarium during its recent show, "Astrology—Fact or Fiction?" revealed that 24 per cent of the persons interviewed revised their opinion of astrology after seeing the show. In answer to the question, "Now that you have seen the sky show, do you think your **previous** opinion of astrology has been changed?" about one quarter answered in the affirmative. Ten per cent were not sure, and 66 per cent claimed no change in their opinion.

The results of question 2, "Which of the following do you believe astrology is?" indicate 12 per cent of the visitors to the Planetarium think it fact, 67 per cent, fiction, and 21 per cent are undetermined.

From under 10 to over 51 were the ages represented by the persons interviewed, with the great majority between 21 and 40. Men and women numbered about equal in the survey, and 43 different cities, 13 different states, were represented.

J. S. PLASKETT

WITH the death of Dr. J. S. Plaskett, on October 17th, Canada has lost one of her most distinguished scientists and respected citizens. The many years that he spent in research were extremely fruitful, and he possessed the happy faculty of being able to examine work from an objective viewpoint.

Dr. Plaskett was born near Woodstock, Ontario, on November 17, 1865, and graduated from the University of Toronto in 1899. He was associated with the Physics Department at this institution from 1890 to 1905, and was then appointed astronomer with the Department of the Interior. He acted in this latter capacity until 1917, at which time he assumed the directorship of the newly-constructed Dominion Astrophysical Observatory, at Victoria, B. C. He remained director until his retirement in 1934.

Dr. Plaskett fortunately combined executive with scientific ability, and much of the credit for the very existence of the Victoria 72-inch reflector must fall to him. His vigorous and enthusiastic appeal for a large telescope in Canada played no small part in the final approval of this project.

Owing to a mechanical training, Dr. Plaskett was well equipped to decide on matters of design and construction in telescopes, and he was deputized to visit observatories in the United States to consider the merits and demerits of the various instruments and mountings. He incorporated his findings into the Victoria telescope, and the excellent work produced at this institution is a fitting tribute to his mechanical skill.

Although he is best known for his researches on the structure and motions in our galaxy, Dr. Plaskett's work included solar observations, the determination of the elements of spectroscopic binary orbits, and a study of the masses and luminosities of the high-temperature *O*-type stars. With Dr. J. A. Pearce he conducted a 10-year research program on the radial velocities, proper motions, parallaxes, and characteristics of class *B* stars. The results of this project have done much toward giving us a model of our galaxy. The same authors studied the motions and distributions of interstellar matter, and showed that statistically speaking, this material was uniformly distributed throughout the galaxy and partook of the general rotary movement.

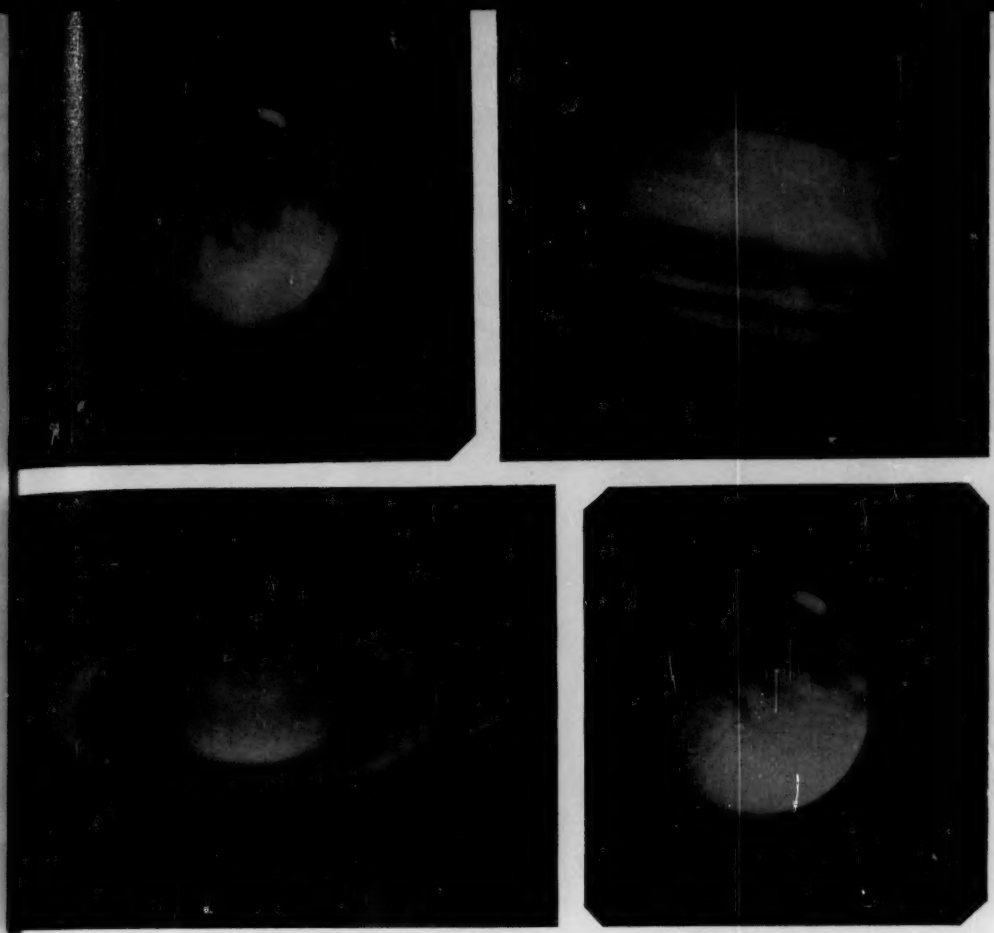
While engaged in his studies of the *O*-type stars, Dr. Plaskett discovered a stellar system of great interest and importance. Previous to his investigation, the star was thought to be single, but a spectroscopic study showed that in reality the system is double. This binary system is one of the most massive known, the combined mass of the components being more than 100 times that of our sun. "Plaskett's stars," as they are called, are extremely luminous; in spite of their great distance, perhaps 10,000 light-years, we see the system as a star of 6th magnitude. This great intrinsic brightness corresponds to a temperature of 30,000° K. The stars are separated by a distance of 55 million miles, and revolve around one another in a period of roughly 14.5 days. This means that the components of the system have high velocities; the earth in its motion around the sun moves at the rate of 18 miles a second, while Plaskett's stars have velocities of 130 miles and 155 miles per second, respectively.

After his retirement as director of the Dominion Astrophysical Observatory in 1934, Dr. Plaskett continued to follow astronomical progress and research. He took a keen interest in the activities of younger astronomers and students, and was always willing to help them to the best of his ability.

He was appointed scientific consultant to the Warner and Swasey Company at Cleveland, and took part in the optical testing of the 82-inch mirror for the McDonald telescope on Mt. Locke in Texas.

Included in the long lists of honors and degrees that were conferred upon him are the following: Fellow of the Royal Society, Fellow of the Royal Astronomical Society, gold medal of the Royal Astronomical Society of London, Henry Draper medal of the National Academy of Sciences, Rumford medal of the Academy of Arts and Sciences; L.L.D. degrees from the universities of British Columbia, McGill and Queens, and an Sc.D. from Pittsburgh. However, he carried his honors lightly, and his unassuming manner combined with his scientific distinction made him doubly respected. Dr. Plaskett possessed that vision which belongs to all truly great scientists, and his death will be felt keenly in the astronomical world.

WILLIAM PETRIE



From the Pic du Midi in France, recent photographs of the planets are shown here: Mars, September 20th, 1h 57m (*upper left*), 2h 16m (*lower right*); Jupiter, September 20th, 3h 44m; Saturn, September 22nd, 3h. Photographs by C. Camichel.

News from Abroad

I HAVE just received a most interesting letter from Dr. Bernard Lyot, written September 25, 1941, from the observatory on the Pic du Midi. His record of the summer program of research at that observatory shows that, despite the war and the numerous difficulties and limitations necessarily imposed by the present state of the world, scientific investigation of the highest importance is still going on in France. Since the publication of the results may be long delayed, I believe that a brief review of them should be made public.

Dr. Lyot has continued his important coronagraph research, with special reference to coronal problems. The season, he reports, was unusually rainy and cloudy. Nevertheless, he had 12 days, of from eight to 12 hours each, that were exceptionally clear. He obtained monochromatic records of the corona and chromosphere simultaneously on three films, the first with the green coronal line, the second with the red line, and the third with the ordinary prominence line, H^{α}. Apparently he was using a polarizing filter, which gave about two angstrom units transmission.

The coronal photographs are of excellent quality, showing decided differences in the structure between the red and the green lines—as indeed eclipse observations have already led us to expect—with rapid changes in the coronal image as shown by the green line.

The coronal line 5694, in the yellow, has been very strong, but the observations have shown no trace of the line at 5536. In addition, Lyot has looked for other coronal radiations in the range from 12,000 to 16,000 angstrom units, that is, in the far infrared, by means of a thermocouple, but without success.

The instrumental equipment at the Pic du Midi, in addition to the coronagraph, consists of a refractor of 23 centimeters aperture. The astronomers have, however, just borrowed from the Observatory of Toulouse an objective of 38 centimeters aperture. Making good use of the excellent seeing conditions prevailing, Lyot's colleague, C. Camichel, has made a special study of the planets and of the four principal satellites of Jupiter. He has taken excellent photographs of the planets themselves, some of which are reproduced with this article. The photograph of Saturn shows a small spot clearly visible on the print, but this may be lost in reproduction. Of special interest is the observation, confirmed by three independent observers, of spots on all four of the bright satellites of the planet Jupiter.

Lyot has returned to Paris, to continue work this winter at the Observatory of Meudon. To Dr. Lyot and his colleagues go the congratulations of scientists all over the world, for their important studies made in the face of difficulties that would have discouraged all but the true scientist.

DONALD H. MENZEL

In response to a letter sent to some dozen persons in or near the path of the eclipse of September 21, 1941, we received, on October 16th, this letter:

I WISH to thank you for your kind letter of August 5th, just received, inviting us to inform you of any observations to be made of the solar eclipse of September 21st.

The present world situation has prevented anyone in New Zealand from considering an expedition to observe this eclipse, and indeed, up to the present, I have not heard of any expedition at all that is setting out to observe it. I should imagine, however, that there will be considerable work done in Russia, and I would not be surprised if the Chinese Academy of Sciences made some observations in their territory.

J. L. THOMSEN
New Zealand Astronomical Society
September 9, 1941.

From a letter to Harvard:

I WAS wounded in a battle a month ago and came a few days ago home for convalescence furlough. An open hole and a shell splinter are still in my back. We are all in Helsinki, and I try to do astronomical work. We can only wish that the war would be soon over.

In the spring I succeeded to finish a paper about the drift of sunspots in latitude. It is going to be printed in *Zeitschrift für Astrophysik*.

Professor Sundman has left the University. Dr. Järnefelt is the substitute director of the observatory, and I keep the assistant's job he had before.

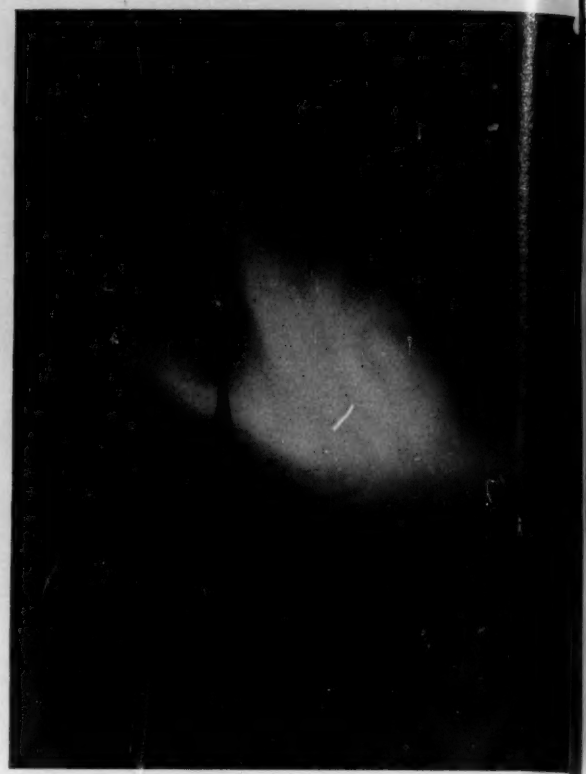
The last letter I got from Professor Rosseland was from January 6, 1941.

When the war is over, and the world is again peaceful, for some time at least, how nice it would be to come again for sometime to America and to Harvard!

JAAKKO TUOMINEN
Astronomical Observatory
Helsinki, Finland
August 21, 1941.

SCIENCE CLUBS OF AMERICA

Over short-wave stations WRUL and WRUW each Monday evening from 9:30 to 10:00 is broadcast a program of science and science club news which reaches all parts of the world. This is conducted by Science Service on behalf of Science Clubs of America. Members of the staff of Harvard College Observatory frequently take part in this program.



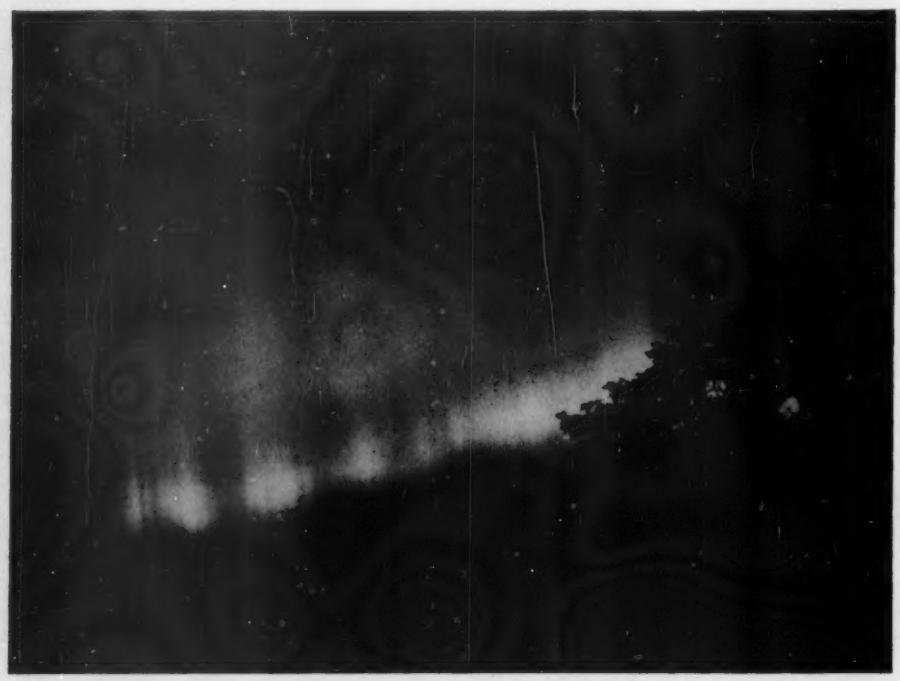
***Above*: This rayed band appeared in the north at 8:10 p.m. E.S.T., colored in red, green, and blue. Some stars of the Big Dipper shine through the upper portion, appearing as short streaks during a 10-second exposure. *Right:* Looking due west from the top of Building D, Harvard College Observatory, Cambridge, Mass., this intense red patch appeared behind a church steeple at 7:50 p.m. These two pictures were taken by R. Newton Mayall, using a 2¼ x 3¼ Voigtlander, Skopar f/4.5 lens, Agfa Super-plenachrome film pack.**

THURSDAY night, September 18th, a magnificent display of the aurora borealis took place. Beginning at about 7:30, before the last rays of twilight had faded, it continued through the night and was still visible at 4:30 a.m. Friday morning, when dawn was approaching. It far outshone any I have ever seen. It attained its greatest brilliancy around 8:00 o'clock, when the auroral corona was very plainly seen near the zenith, with great long streamers projecting out toward the horizon. The corona at times glowed with a very soft purple color. I was impressed by the extension of the aurora so far in the southern sky, even as to engulf the constellations of the zodiac.

Later in the evening, swift flashy motions took place. During this stage no color except whitish was noticed. The flashes gave way about midnight to a calmer pattern, similar to that of the earlier hours. The long spiky rays seemed to form a kind of curtain-like structure hanging throughout the whole northern sky.

This unusual performance was preceded by two less conspicuous displays, one on the 13th, the other on the 15th, and was followed by one on the 20th. It is also interesting to note that a gigantic group of spots was visible on the sun.

WILLIAM A. DIETRICH
Triadelphia, W. Va.



Looking NW by N, Kurt W. Opperman, of Riverhead, L. I., photographed this rayed band at 8:20 p.m. Note the Big Dipper stars, including Alcor. Exposure, 30 seconds, f/2, 35 mm. Ultra-speed Pan, uranium intensified.

ALMOST brilliant display of northern lights was seen this evening, September 18th, from about 7:15 p.m. till 8:30 p.m.

When first seen, the sky was filled with long, silvery streaks of light east of the Milky Way. Occasionally they seemed like searchlight beams. Then they would gather in seemingly double rows of curtains. These curtains moved as if they were blown by the wind.

Next the whole mass centered directly in the Northern Cross. Here it looked like a giant cap or dome from which the streamers, now distinctly red and pale green, radiated in all directions.

After this the light beams fluctuated like a giant searchlight, sometimes from the horizon and sometimes from the Northern Cross. As the display lessened, small swirls of light shot through the long beams in a shimmering effect across the sky. I would say that the center of this whole display lay definitely in the Northern Cross. Toward the end of the display, the sky appeared diffused with a pale light and the stars were notably dimmer.

MARY PHILIPS YOUNG
Johnstown, Pa.

MAYBE you would like to know how the northern lights appeared to the people of Sumter the night of September 18th.

I was sitting on my back porch, the time 7:15 p.m., waiting for the sky to get dark, as it was a perfect night to do some comet seeking, but for some reason the heavens would not darken. At that time I noticed a cone of light, but very dim, across the bowl of the Big Dipper; two minutes later there was another about five

AURORAL BURST SUPREME

Rarely does an occasion warrant a pictorial spread like this, but equally infrequently does nature provide northern lights to equal those of September 18-19th. Pictures and letters from all parts of the country attest the glory and extent of the display. We are pleased to present some of them here, with a collective acknowledgement to all persons who reported the aurora or sent in pictures. All times mentioned are Eastern Standard. See the next page for a description of auroral forms, practically all of which were observed on the 18-19th.

From Farmingdale, L. I., Fred Schmid pointed his camera east at 7:50 p.m., to get the end of the band stretching overhead, and the planet Mars in the lower center. 30-seconds exposure at f/6.3 on Super XX.

degrees farther north, also dim, and I thought it was a distant spotlight. The heavens seemed to light up with a deep silver gray. Then I felt I knew what was coming.

At 7:30 there appeared several cones of white light to the northeast, and then rapidly many cones to the left and below Polaris, of white and pink light; then they began to form and blend rapidly and seemed to drift to the northwest—time 7:35. A large red area had formed over the Great Dipper. At 7:40 the display was at its height, and the many shifting, drifting cones of white, red, and pink light I have never before seen; and a person was easily recognizable at 10 or more feet.

I was busy making notes, and trying to let such beauty soak into my mind, and from my notes I see at 7:40 the whole of Cassiopeia, Polaris, and the greater part of the Great Bear were blotted out, only Mizar being very dimly seen. The streamers also made most of the stars in the head of Draco, the Dragon, invisible, and some streamers were as high as Vega. To top it all off, three meteors swept below the north star in rapid succession.

This display lasted for 10 minutes, but the lights were not through yet, but continued on until 8:12, when they rapidly grew dim, and by 8:40 there was only an occasional white streamer.

You may rest assured I had forgotten all about comets during that time.

The following day I observed the sun at 2:30 p.m. I was able to count 39 individual spots in one group toward the limb of the sun; there were several smaller blended spots, and three isolated spots.

EARL C. WITHERSPOON
Sumter, S. C.

ON Thursday evening, that is, September 18th, there occurred in these parts a most spectacular phenomenon. . . . The show started early and continued all night.

About 8:00 o'clock, when I first spied it, the whole sky, except a small cone to the south, had a light of veil-like density. . . . While the great body of glow changed in form slowly, a more dynamic spread originated near the horizon and sped to the zenith, leaving at times a cumulus effect. Streamers came from all points with the greatest activity along the zodiac. At 4:00 a.m. there was more of the static element taking in the zodiacal path and all of the northern sky. . . .

These lights on the whole were most enthralling. They effected a grip on the emotions; even the memory of them quiets any gross attitudes. . . .

The show was variously received by the spectators: the milkman explained that it was an optical illusion; and the waitress who was entirely absorbed in the idea said it was a reflection from the icebergs and would last three nights. A man from Canada, naturally having great weight of opinion, said it was just the northern lights though in truth it was more east and west. . . .

WILLIAM T. RYAN
Hammond, Ind.

Below are shown the gorgeous corona, a feature of the display unusual so far south, and auroral light filling the southern half of the sky, while the north was quite dark. *Left:* The corona at 8:10 p.m., camera pointed overhead. Note Altair in lower center, and Delphinus in left center. *Right:* A bit to the south of the zenith at 8:00 p.m., exposure 22 seconds. These pictures were taken at Patchogue, L. I., by E. Dayton Thorne, using Agfa Super Pan Press, f/3.5. J. H. King, of Chatham, N. J., also sent in good pictures of the corona. Messrs. Schmid, Thorne, and King are all Long Island Astronomical Society members.

Description of Auroral Forms

SO great is the interest in the northern lights since the outburst of September 18-19th, and so many persons kept records and pictures of what they saw, that we reprint here from The SKY for January, 1941, a description of auroral forms, furnished by Dr. C. W. Gartlein, director of the National Geographic—Cornell University Study of Aurorae. See also The SKY for December, 1940, for other material.

The descriptions given below are from the works of Prof. Carl Störmer, Prof. Vegard, and others and follow the terminology developed by Prof. Störmer and generally used in this work. The standard abbreviation precedes the descriptive words and should be used in all tabulations.

G Glow. A faint glow near the horizon, resembling the dawn, usually white or greenish color but sometimes red. This is often the upper part of an arc whose lower border is below the horizon.

HA Homogeneous Arc. The arc is usually diffuse above and sharply defined below. It may be near the horizon or quite isolated high in the sky. Sometimes several parallel arcs occur and may be connected at one end by a sharp curve. The color is usually greenish-yellow or nearly white. The arc often gradually climbs up the sky and may later have a very luminous irregular lower border and soon after break into rays (type RA). The arc is usually set almost at right angles to the magnetic meridian. Often only parts of arcs are visible.

HB Homogeneous Band. This band has a more irregular form than the homogeneous arc. It may vary from narrow to very wide. The lower border is often irregular and sharply defined. It may sometimes consist of a segment of approximately semicircular shape which may move across the sky in the direction of the usual arcs HA. The band may have folds and resemble a large curtain. These usually change into bands with ray structure (type RB). The color is usually bluish-white.

PA Pulsating Arc. Arcs, or parts of them, may flash up and disappear rhythmically with a period of 1 to 30 seconds. The color is usually bluish-green.

DS Diffuse Surface. A diffuse veil or glow, often over large parts of the sky. It may resemble clouds and often appears after rays or curtains. The color may range from violet-white to an intense red.

PS Pulsating Surface. A diffuse patch or surface which appears and disappears rhythmically. Near the zenith the boundary may be sharper. Often appears with or as part of a flaming aurora (type F).

RA Rayed Arc. An arc with ray structure. A quiet homogeneous arc often becomes very luminous and then breaks into rays. The rays may be short or long and may vary in brightness along their length.

RB Rayed Band. A band with ray structure. Resembles the bands type HB but composed of rays. The rays may be close together or scattered along the band. Several parallel bands may appear. Near the magnetic zenith the bands may form a corona.

D Draperies. When bundles of rays become long the band often assumes the form of a curtain or drapery. The lower border is often more luminous. Near the zenith they have a fanlike form or partial corona.

R Rays. Rays resemble searchlight beams in a dusty atmosphere. The rays may appear isolated or in great bundles. They are usually greenish-yellow but may be red. Rays often appear with other auroral forms.

C Corona. When rays approach the magnetic zenith they seem to converge to a point because of perspective. The corona may be formed by long or short rays, by bands or by draperies.

F Flaming Aurora. A quick-moving form consisting of waves of luminosity moving toward the zenith or of invisible waves which cause parts of arcs, bands, or patches to appear and disappear rhythmically. Often appears after strong displays of rays and curtains and is often followed by the formation of a corona.

Dr. Gartlein, during the recent A.A.V.S.O. meeting, said that he began observing and photographing the display at midnight September 17th, although it did not attract general attention until the following evening, at which time the sky was clear over practically the entire United States—a rare and fortunate circumstance. On Friday night—the 19-20th, there was no aurora, but on the morning of Sunday, the 21st, the display really ended with an isolated arc in the sky.

The Cornell aurora expert said that this display apparently lasted a longer time, was brighter for more of the time, covered more of the sky at once, and was seen by more people at one time than any similar phenomenon since September 1, 1859. On that date the aurora accompanied one of the five greatest magnetic storms of all time.

Among other points, the following facts were mentioned by Dr. Gartlein.

1. General descriptions of the aurora are not of much scientific use unless they include definite features observed at definite times. The lower edges of homogeneous arcs should be measured for height above the horizon.

2. Always photograph the corona, as the direction from the observer to the center of the corona is that of the magnetic field high in the atmosphere—this is the only way to find the magnetic direction at heights greater than 100 kilometers.

3. The aurora is usually long in longitude, narrow in latitude.

4. Only one phenomenon was not reported for the recent display—that of an aurora seen between the observer and a building! Two persons reported hearing rustling sounds, similar to those authentically reported by Prof. Carl Störmer and his Norwegian colleagues.

5. Contraction and expansion of the atmosphere changes auroral heights—by as much as 50 per cent.

6. Following a striking display, the greatest probability of recurrence is for the following night; next, in 58 days; next, in 27 days. April and September have had the largest number of displays, but this has nothing to do with the seasons on the earth. It is caused by the changing path of sunspot areas across the visible hemisphere of the sun during the year. This is a result of the inclination of the sun's axis.

7. Red is the least intense auroral color, at least as far as our eyes are concerned. Consequently, red patches are usually seen in the east or west, because of the greater depth of the aurora in those directions.

8. As measured by the intensity of the auroral green line, a display begins in step with an accompanying magnetic storm.

BEGINNER'S PAGE

By George V. Plachy

The Moon: *Our Beneficent and Mysterious Satellite*

TO the early Greeks the moon was an object of reverent admiration, and at Ephesus was built one of the greatest temples of ancient times to the goddess of the moon, whom they named Diana, or Selene. Modern study of lunar topography is thus called **selenography.**

Despite the exhaustive studies of the moon made during the last 300 years, our satellite remains one of the most mysterious of all celestial objects. In 1609, when Galileo first focused an astronomical telescope on the moon, he expressed his admiration and wonder by writing, "A most beautiful and rapturous sight to behold. . . . It does not possess a smoothe and polished surface but is rough and uneven and, similar to the earth itself, is everywhere full of vast protruberances, deep chasms, and sinuosities."

Let us consider first what part the moon plays in the general picture of our solar system. The moon is one of a class of astronomical bodies called **satellites.** There are 28 known satellites, or moons, in the solar system, all of which revolve around planets. Jupiter has 11 moons, Saturn has nine, Uranus, four, Mars, two, Neptune and the earth each have one. No moons have as yet been discovered revolving around Mercury, Venus, or Pluto. Among all these satellites, however, our own moon is the largest in relation to its primary (the planet earth). The moon is 2,160 miles in diameter or roughly one-quarter the diameter of the earth. Two of Jupiter's moons are 3,200 miles in diameter, but these are only 1/27 the size of Jupiter itself. One of Saturn's moons also is about 1/27 of the planet's size. Neptune's single moon (3,000 miles) is about 1/10 of the parent planet. At the other extreme, Jupiter's two moons, Nos. **X** and **XI,** discovered in 1938 by Nicholson, are a mere 1/6,000 the diameter of Jupiter.

The moon's period of revolution about the earth is 27⅓ days, and its **time of** rotation on its own axis is **exactly** the same—as a consequence of which the same face of the moon is always directed toward the earth. Astronomers would give much to see the other half of the moon, but there is no reason to believe it is very different from the side we see. Actually, about 59 per cent of the moon's surface can be seen due to certain irregularities of its motions, to the inclination of 6½ degrees of the lunar equator to its orbit around the earth, and to our observing it from far-separated points on the earth. These effects are called **librations.**

The density of the moon is about 3⅓ times that of water. This is very close to the average density of the surface rocks and crust of the earth and tends to support the theory that the moon was indeed once a part of the earth and was torn away by some outside influence. Other evidence, however, indicates that the moon was formed at the time of the birth of the entire solar system, with the earth, the other planets and all the satellites, and that the earth later captured the moon.

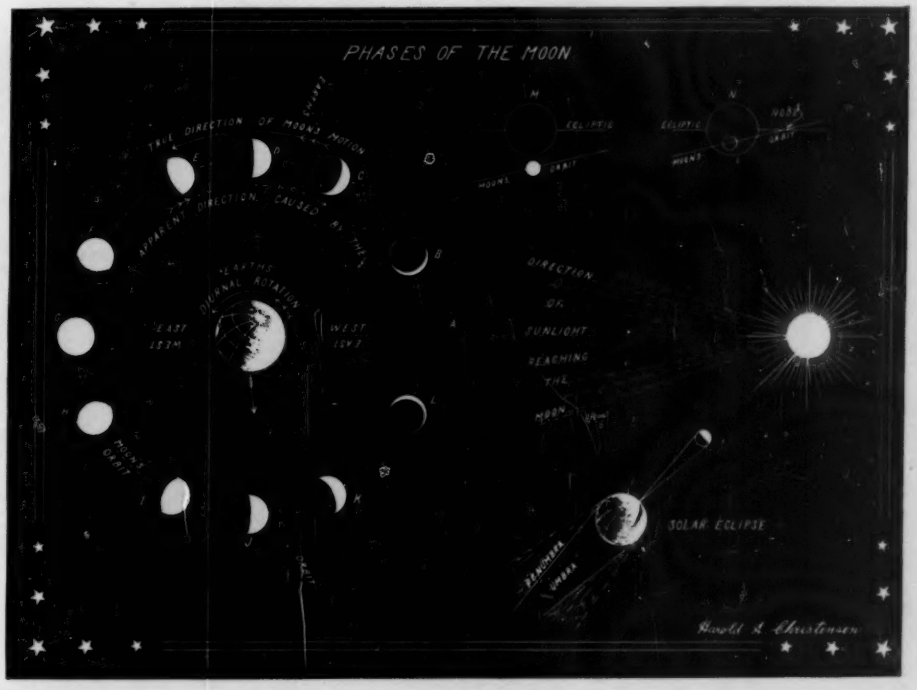
The weight of any object on the surface of the moon is only one sixth as much as it would be on the earth. A person weighing here 120 pounds would tip spring scales at only 20 pounds on the moon. It is principally because of this low **surface gravity** that the moon has been unable to retain an atmosphere comparable to the earth's. From the practically airless moon, one could see the stars at all times, outlined against a black sky. During the day, precautions against the glare of the sun would have to be taken.

In the night sky, the full moon dominates the celestial canopy. Its mellow, silvery light inspires and serves poet, painter, and layman alike. Its practical values are not often fully realized. Some of them are:

1. The direct inspiration and incentive to early peoples to study astronomy—due to the moon's prominence in the sky and its (then) mysterious phases.
2. The creation of tides, permitting navigation over ordinarily shallow waters, and clearing the shores of debris and decaying materials.
3. Service of the phases as a lunar calendar, giving a unit of natural time intermediate between the day and the year.
4. The obscuration of the glare of the sun by the moon during solar eclipses, permitting study of the sun's outer atmosphere (chromosphere, prominences, and corona).
5. The direct service of the moon's light in illuminating the harvest fields, countryside, and polar nights.
6. The nearness to the earth makes it possible to study the moon's physical characteristics and motions in greater detail than any other celestial body.

The moon's recurring cycle of **phases** is caused by the change of the moon's position in its orbit relative to the earth and sun. The moon is constantly revolving around the earth and since our satellite has no intrinsic light of its own, an observer on the earth sees varying amounts of the sunlit half of the moon as the latter changes its position relative to us. When the earth is between the sun and the moon, we see the entire illuminated hemisphere of the moon—and this is called the **full moon.** When the moon lies between us and the sun, the dark side of the moon faces us and we cannot see the moon at all—this is the **new moon.** At intermediate orbital positions of the moon, called **first** and **last quarter,** we see only one half of the illuminated area. There is a gradual transition between these phases over a period of 29½ days. The actual period of revolution of the moon around the earth is 27⅓ days (sidereal period), but the phases follow the slightly longer period (synodic period) due to the earth's own annual motion around the sun. Were the phases an annual phenomenon instead of monthly, they would more likely attract the attention they deserve.

The most detailed astronomical photographs made of any celestial object are those of the face of the moon. Over the entire lunar surface are evidences of cataclysmic disturbances and upheavals which probably occurred millions of years ago. The back-cover picture this month shows the full moon. On this page next month we shall continue this study of the earth's nearest permanent neighbor.



"AMERICANS MAP THE SKY"

This is the title of a series of radio broadcasts currently being conducted over the Columbia Broadcasting System, Fridays, 3:45 to 3:55 p.m. Wm. H. Barton, Jr., executive curator of the Hayden Planetarium, checks the script and takes part in this program.

GLEANINGS FOR A. T. M.s

EDITED BY EARLE B. BROWN

HENRY FITZ—EARLY AMERICAN TELESCOPE MAKER

NINETEENTH-CENTURY America produced three telescope-making establishments that will be especially remembered by posterity—those of Henry Fitz, Alvan Clark, and John Alfred Brashear. While two books have been devoted to the achievements of Brashear, and many articles to the scientific exploits of Clark and his sons, their predecessor in the art of telescope making, Henry Fitz, has not been fortunate in finding an adequate biographer to rescue him from the undeserved limbo of oblivion into which he is swiftly falling. Although he remains almost unknown even among the guild of amateur telescope makers in this country, the record of his instrument manufacture seems quite impressive even today. While it is now probably too late to reconstruct a detailed biography of Fitz, this country's first important telescope manufacturer, a few of the salient points in his career can be pieced together.

Henry Fitz was born in Newburyport, Mass., on December 31, 1808, the son of Henry and Susan Bradley Page Fitz. His paternal grandfather, Mark Fitz, was town clerk of Newburyport and was prominent enough to be mentioned in the town histories. Young Henry became first a printer and then a locksmith. In the latter occupation, in which he prospered, he is said to have been able to do two days' work in one, and was soon devoting his surplus time to experimenting with optical glass.

As early as 1835, he had constructed his first reflecting telescope, but like his illustrious successors, Clark and Brashear, he was to make a name for himself when he turned to refracting telescopes. During the year 1844, he was perfecting object glasses; the lens for his first refractor is said to have been polished from the bottom of an ordinary drinking tumbler. The next autumn, his exhibit at the Fair of the American Institute of an instrument with a 6-inch aperture brought him to the attention of the public, and though his lens had been ground from ordinary American flint glass, the instrument was considered sufficiently good to bring him business. Turning professional, Fitz set up a telescope-making establishment in New York and devoted all his energies to his new business. Self-taught in his methods, he became adept at local polishing, being perhaps a decade in advance of some of his European contemporaries in this technique. He was keenly aware that the heat from one's fingers can produce a considerable effect on the curvature of a lens. In a period when optical glass was scarce in America, his finely ground object glasses were highly prized.

Fitz manufactured a large number of 6-inch telescopes. The first order for an American-made lens of what was then deemed to be of considerable size was placed by Lt. James Melville Gilliss, who took it with him on the Government-financed expedition he headed to Santiago, Chile, to observe Venus and Mars from 1849 to 1852. This instrument ultimately found a permanent home in an observatory of the Chilean government. With another Fitz 6-inch telescope, Robert Van Arsdale of Newark, N. J., was able to discover several comets. For the astrophysicist, Lewis Morris Rutherfurd, Fitz made five telescopes—of 4-, 5¾-, 6-, 9-, and 11¼-inch aperture, the last giving very exceptional definition. For a time, using only a 4½-inch Fitz telescope lens, Lewis Swift made a fine record as a comet discoverer.

Henry Fitz seems soon to have contracted that disease which sooner or later afflicts all telescope makers, namely an overwhelming compulsion to build ever bigger and better telescopes. He constructed various 8- and 9-inch refractors, including a 9-inch belonging to a British charge d'affaires at Montevideo. An instrument of 10 inches was furnished to Mr. Vickers of Baltimore. Twelve-inch telescopes were supplied to the University of Michigan and Vassar College. He built a 13-inch for the Dudley Observatory at Albany, N. Y., and another for a group of amateurs in Allegheny, Pa. A 16-inch went to Mr. Van Duzee of Buffalo.

These latter instruments ranked among the largest in the nation at the time. Finally, death overtook Henry Fitz after a brief illness on October 31, 1863, just as he was about to sail for Europe to select the glass to fulfill the ambition of his later years for a 24-inch telescope.

RALPH S. BATES
Massachusetts Institute of Technology

TWENTY-INCH OPERATIONS

The Springfield Telescope and Reflector Society (STARS) reports on the preparation of its 20-inch mirror as follows:

Preparation for Grinding: Disk ground cylindrical and edges beveled with #60 carbo—25 hours. Top surface ground flat and partially polished for bubble examination. Bottom side selected for finishing, and ground parallel to top—28 hours.

Roughing Out: Roughed out with a 12½-inch Pyrex tool, previously ground convex with a tool built up from 3¼-inch glass disks, and covered with steel washers pitched on. Tool and mirror finally ground into contact.

Fine Grinding: Done with an 18-inch cast-iron tool backed with non-symmetrical ribs; tool covered with 2″ x ¼″ glass facets pitched on. Carbos used: 80-120-150-300-400-500-600-1200-1400.

Polish: Polished with pitch lap made on the 12½-inch Pyrex tool. Polished 50 hours, and found to be spherical, with a good figure.

CARL F. ALSING, pres.,
Faculty St., Wilbraham, Mass.

ED. NOTE: "Gleanings" is interested in getting information similar to the above for other 20-inch mirrors which have been made by various societies throughout the country, for the preparation of a chart of the different techniques which have been used. Communications from anyone in a position to furnish such information will be appreciated.

COLLIMATING

COLLIMATING a telescope—lining up the optical parts—is sometimes a difficult task, and many methods have been advanced to simplify the technique.

One of the most effective, which has the advantage of requiring no additional apparatus, is that which might be called the double-eyepiece method.

The telescope (we speak of reflectors, now) is aligned as well as possible by sighting through the open draw-tube of the eyepiece holder and adjusting mirror and diagonal until the image of the spider seen against the mirror appears central.

The telescope is then pointed toward a daytime sky, or a white ceiling, or other suitable source of diffused light, and the eyepiece is placed in position, as if for observing. Then another eyepiece is placed over the first, and the Ramsden disk of the telescope examined with this second eyepiece.

The mirror, diagonal, eyepiece draw-tube, and eye of the observer are all seen, and all should be concentric with one another if the telescope is properly collimated.

It will be found that if one of the three mirror adjustments is located in a plane which includes the optical axis and the axis of the eyepiece, it will be much simpler to determine which adjustment needs changing when the collimation is done. It is advisable, also, to provide for rotating, shifting laterally and vertically, and rocking the diagonal. E. B. B.

NOTE ON FITZ LENS: Public peeks at the stars are taken through a Fitz 12-inch lens mounted on the automobile of Ed Ballod, a well-known "42nd Street astronomer," in New York City.

DO YOU KNOW?

By L. J. LAFLEUR

I. Score four points for each question correctly answered, and one point for each question where you do not attempt to select the answer.

1. One of the following constellations does not contain part of the Milky Way:
   a. Hydra c. Perseus
   b. Cassiopeia d. Taurus
2. The center of the moon never appears to be in
   a. Ophiuchus c. Cetus
   b. Sextans d. Hydra
3. The planet whose size is nearest that of the earth is
   a. Venus c. Neptune
   b. Mars d. Pluto
4. The maximum value for the aberration of light is about
   a. 21″ c. 1′ 13″
   b. 43″ d. 2′ 17″
5. The winter solstice is the place in the sky where the sun is
   a. at its extreme distance south of the equator
   b. at its extreme distance north of the equator
   c. on the equator going north
   d. on the equator going south
6. The density of the earth's crust is
   a. almost half again that of water
   b. about twice that of water
   c. between two and three times that of water
   d. over three and a half times that of water
7. One of the following constellations lies on the ecliptic:
   a. Gemini c. Corona Borealis
   b. Andromeda d. Delphinus
8. Astronomical latitude differs from geographic latitude because of
   a. the oblateness of the earth
   b. the precession of the equinoxes
   c. the "variation in latitude"
   d. local irregularities of the earth's surface
9. One of the following is not the brightest star in its constellation:
   a. Alpha Aurigae c. Alpha Leonis
   b. Alpha Draconis d. Alpha Crucis
10. There is no 1st-magnitude star in
    a. Auriga c. Cassiopeia
    b. Lyra d. Canis Major

II. Count five points for each question correctly answered.

1. What is a Cassegrainian telescope?
2. Give the proper names of three 4th- or 5th-magnitude stars.
3. To the nearest year, what is the average cycle of sunspot activity?

III. Each of the following groups of words can be rearranged to form a sentence of astronomical significance. Count 15 points for each sentence you can construct.

1. a, and, as, became, believed, directly, each, encounter, had, is, it, Neptune, of, once, one, other, planet, Pluto, result, retrograde, revolving, satellites, that, that, the, the, their, two, (west to east).
2. a, an, apart, between, century, eight, in, interval, occur, of, of, over, pairs, pairs, transits, Venus, with, years.
3. a, be, by, Chinese, Crab, disintegration, expanding, explosion, from, giant, in, is, known, nebula, now, observed, of, of, product, resulting, stellar, supernova, the, the, the, the, to, 1054.

(*Answers on page 24*)

GLEANINGS is always open for comments, contributions, suggestions, and questions, from its readers. We are here to serve, in every possible way, those of the telescope-making fraternity who are among the readers of *Sky and Telescope*.

Amateur Astronomers

To All Amateur Astronomers:

IN order to insure all interested persons receiving a copy, and to make possible reprints as required, the proposed by-laws of the Amateur Astronomers League of America are published here. This is in accordance with the resolution of the Third National Convention of Amateur Astronomers, meeting in Washington, D. C., July 4-6, 1941.

It should be emphasized that these are only **proposed by-laws,** and subject to revision in all parts. The purpose of publishing these is to furnish material for discussion among individuals and societies, and to request that suggestions for improvement and revision be sent to the undersigned. He will collect such suggestions as are feasible and submit them to those organizations of amateur astronomers which officially report that they are interested in joining the League. Such organizations should state, if possible, the conditions under which they would join the League, or state what revisions, if any, they desire in these proposed by-laws.

As a matter of habit, many persons abhor constitutions, by-laws, and all legal-sounding affairs. Nevertheless, it is necessary that a fairly sound organization be planned if it is to be permanent, and if difficulties of many kinds are to be avoided in the future. Well-written by-laws (which it is hoped these will be) can save hours of discussion and indecision in council and convention meetings. It is hoped, therefore, that amateurs with knowledge of matters of this kind will take the time to study these by-laws carefully. Reprints in any quantity may be obtained on request.

From the proceedings of the Third National Convention (as yet unpublished) the following is self-explanatory:

> Mr. Federer read the proposed by-laws (constitution) for an organization of amateur astronomical societies, to be called the Amateur Astronomers League of America, as drawn up by the Committee on Permanent Organization. The following were the major items covered in the ensuing discussion:
>
> **1. Astrology.** The provision that one of the purposes of the new organization shall be to provide an active force against astrology was discussed at length. A motion to take this provision out was defeated by a vote of the delegates present, 17 to 20.
>
> **2. Membership.** It was generally agreed that this be limited to amateur astronomical societies, and not be open to individuals or professional organizations. Decision as to what constitutes minimum individual membership for a society to be recognized as such should be made by the national council; the same body could make provision for membership by high-school clubs and other junior groups.
>
> **3. Publication.** It was suggested that the least complicated way of spreading information would be by a monthly pub-

Proposed By-Laws of Amateur Astronomers League of America

PREAMBLE: The purposes of the Amateur Astronomers League of America shall be:

a. To coordinate the interests of amateur astronomical societies;
b. To encourage and unify amateur astronomical activities;
c. To secure to individual member societies benefits accruing through membership in this League;
d. To cooperate in any way possible with professional astronomers;
e. To provide through education an active force against astrology.

Article I—Definitions

Section 1. Whenever in these by-laws used, the word "League" shall mean the Amateur Astronomers League of America.

Section 2. Whenever in these by-laws used, the word "organization" shall mean an amateur astronomical society which is a member of the League.

Section 3. Whenever in these by-laws used, the words "individual member" shall mean the individuals who are members in good standing of an organization.

Article II—Membership

Section 1. Any bona fide organization of amateur astronomers may become a member of the League by paying to the national treasurer the full amount of the proper dues, by ratification of these by-laws by the proper authorities of such organization, and by approval of the national council of the League.

Section 2. As long as its national dues are paid, each organization shall have privileges including:

A. The right to send to each annual national convention one official delegate, and an additional official delegate for each 25 members in good standing above the first 10, but not exceeding 10 official delegates in all.
B. The right to be represented in the regional council of the region in which the organization is located.
C. The right to receive all official notices and publications of the League, including the official periodical, which shall be sent directly to members by national headquarters.

Article III—Officers

Section 1. The national officers shall be a national president, national vice-president, national secretary, and national treasurer. In addition, there shall be a permanent secretary, appointed by the national council.

Section 2. The national officers shall be elected by a majority vote of the official delegates present at each annual national convention.

Section 3. No two of the national officers shall be from one region, except that until four regions are established, at least one officer shall be chosen from each region established.

Section 4. The terms of office of the national officers shall be for one year, beginning at noon, Washington Civil Time, each September 1st, except that if the annual convention in any given year shall not have been held by September 1st, then the terms of the national officers then in office shall not expire until the close of the national convention, but their successors shall serve only until noon of the following September 1st.

Section 5. The duties of the officers of the League shall be:

A. The national president shall preside over the national convention and all meetings of the national council and shall be an ex-officio member of all national committees. He shall call special meetings of the national council whenever necessary. He shall have such other powers and duties as prescribed by the national council.
B. The national vice-president shall assist the national president in the discharge of his duties and shall perform his duties in case of absence, death, disability or resignation of the national president.
C. The national secretary shall record and preserve the minutes of each national convention and of the meetings of the national council; he shall issue notices of national council meetings to each council member, and shall assume other secretarial duties upon the direction of the national council.
D. The national treasurer shall collect all dues and other money due to the League and shall keep proper books of account of all items; he shall place the funds of the League in a depository approved by the national council, and dispose of such funds as prescribed by the national council.
E. The permanent secretary shall issue a report of the national convention proceedings to each organization within two months after the close of each national convention; he shall maintain the national headquarters of the League; he shall furnish the publisher of the official periodical with the names of individual members to whom it is to be sent; and shall perform such other duties as prescribed by the national council.

Article IV—National Council

Section 1. The national council shall consist of one member from each region provided for in

Article VIII, Section 1, in addition to the four national officers and the permanent secretary.

Section 2. Members of the national council other than the officers of the League shall be elected by the regional councils in such a manner as to hold office for three years each in an annual staggered arrangement as directed by the national council. The terms of one-third of the members of the national council other than officers of the League shall expire each year.

Section 3. The national council shall have charge of all business of the League except as otherwise specified herein, but shall not interfere with the local affairs of any organization.

Section 4. In the event of death, resignation or disability of any national officer other than the national president, the national president shall appoint a nominating committee from among the members of the national council other than the national officers. This nominating committee shall name at least two candidates for the vacant office, whose names shall be submitted to the members of the national council for a mail vote. If the person elected shall at such time be a member of the national council, then the region represented by him shall elect another person to fill his place on the national council for the remainder of his term.

Section 5. A majority vote of all members of the national council shall be necessary for authorization of general business, except as otherwise provided.

Section 6. The national council shall hold a meeting annually at the time and place of the national convention.

Article V—Headquarters

Section 1. The headquarters of the League shall be located at Harvard College Observatory, Cambridge, Mass., or at such other place as the national council may from time to time direct.

Article VI—Dues and Publication

Section 1. Each organization shall pay an initiation fee of three dollars to the national treasurer.

Section 2. In addition, annual dues fixed by the national council, but not exceeding two dollars for each individual member, shall be paid by each organization to the national treasurer.

Section 3. These per capita dues of Section 2 shall include the cost of the official journal to be sent to the individual members for whom such dues are paid, and the cost of all other national publications. The official journal shall be selected by the national council.

Article VII—National Convention

Section 1. Each year a national convention shall be held, at a time and place designated by the convention of the previous year. The Fourth National Convention of Amateur Astronomers, to be held in Detroit, Mich., July 4-5, 1942, shall choose the time and place for the national convention of this League in 1943.

Section 2. The regional council in which the national convention is located shall conduct the convention that year.

Section 3. The registration fee per capita at national conventions shall not exceed one dollar for individual members.

Article VIII—Regions, Regional Councils, and Regional Conventions

Section 1. Regions shall be established by the organizations concerned, their extent and center located, subject to the approval of the national council. As finally organized, all parts of the United States shall be included, and there shall not be more than 10 regions.

Section 2. Each region shall be governed by a regional council, whose members shall be elected in a manner and for terms of office as agreed by the organizations located in the region, subject to approval by the national council. Each regional council shall elect a representative on the national council, as provided in Article IV, Section 1.

Section 3. Regional conventions may be held, but the national convention shall be considered the regional convention for the year in that region in which it is held. Regional conventions shall be conducted by the respective regional councils.

Article IX—Adoption of These By-Laws

Section 1. These by-laws shall become effective immediately upon ratification by at last 10 bona fide organizations ratifying them in such manner as each deems fit.

Section 2. Within 60 days of ratification, the organizations shall elect a temporary council by a mail vote. This temporary council shall conduct the affairs of the League until the next national convention.

Section 3. Delegates sent to the first national convention after ratification of these by-laws shall elect national officers. These national officers shall constitute the national council, and shall approve the organization of such regions as may be ready for establishment immediately upon the close of the national convention.

Section 4. The councils for each region so established shall elect one member to the national council, whose term shall begin immediately, and expire as determined by the national council in accordance with Article IV, Section 2.

Article X—Amendments

Section 1. Amendments to these by-laws shall be proposed by a two-thirds vote of the national council and they shall become effective after ratification by a mail vote of two-thirds of the organizations.

lication taken by all the individual members of member societies. Mr. Federer said that The SKY could enlarge its page, **Amateur Astronomers,** and change the title to **Amateur Astronomers League of America.** He said the list, **Here and There with Amateurs,** could be enlarged, and would eventually be a list of the societies in the League.

4. Dues. A resolution was passed setting an annual upper limit of $2.00 per individual member of societies in the League, this to include a monthly magazine and other publications. Mr. Federer explained how the New York A.A.A. now takes The SKY for all of its members for $1.50 each, instead of the regular subscription price of $2.00. He said that if The SKY were adopted by the League, the price to member societies would be $1.33 to start, which might be reduced to $1.25 as soon as most existing societies had joined. This would leave up to 67c per individual in the first case, and up to 75c in the second, to be used in running the A.A.L.A., if the annual dues were set as high as $2.00, the limit adopted by the Convention. If the dues were $1.50, 17c would remain for national expenses, and on this basis, many societies would be able to join the League without changing their present dues or by-laws. However, it was agreed that the matter of dues should be decided by the first 10 or more societies ratifying the proposed by-laws.

5. Initial Costs and Dues. It was resolved that the initiation fee should be $3.00 per society, and that preliminary expenses of printing and postage be covered by such fees from the first societies to form the League.

6. Adoption of the By-Laws. This is provided for in the proposed by-laws themselves. It was resolved that the chairman of the Committee on Permanent Organization send copies to all known societies, soliciting comment thereon. The suggested changes are to be voted upon by mail by all groups answering the first letter, and the resultant by-laws are to be submitted to **all** societies for ratification.

7. Revisions in the proposed by-laws were made by the Convention, and these have been embodied in the accompanying copy.

Please refer to the editorial in the August SKY and to the **Amateur Astronomers** page in the October SKY for further comments on the League. The suggestions concerning The SKY made in Washington apply also to **Sky and Telescope.** Harvard College Observatory has been inserted in the proposed by-laws as headquarters for the League, since it is obvious that the support of this institution, if it is accepted, will solve many problems, physical and financial. West Coast groups are especially referred to the August editorial, and to the provisions for regions and regional conventions.

CHARLES A. FEDERER, JR.
Chairman, Comm. on Perm. Org.
Harvard College Observatory
Cambridge, Mass.

BOOKS AND THE SKY

BIOGRAPHY OF THE EARTH

GEORGE GAMOW. The Viking Press, New York, 1941. 242 pages. $3.00.

OF all the absorbing problems in science, none can claim wider interest than the past and future of the earth. By what mode the sun's retinue of planets came into existence; how one of the small globes in the solar system cooled and acquired an ever-attendant partner; the way in which the planet's surface solidified, formed continents with vast mountain chains; how life appeared and developed, and what the next few billion years hold in store for the earth, form the basic subject matter of **The Biography of the Earth**, by Prof. George Gamow. The material of this book is all-embracing and necessarily requires the author to have a reasonably good acquaintance with many branches of science. In some he is comfortably at home, but in others he lacks the critical viewpoint which comes only from an intimate knowledge of the pros and cons of each debated theory.

Prof. Gamow chose to do this book in broad strokes; and in his customary easily-flowing style, with simple but pertinent sketches, it reads well. The subject matter is vast; each chapter represents the information distilled from volumes. Obvious limitations of space prohibit critical discussion of debatable theories; to the pedantic such minutia seem essential, but in the broad picture, sketched for a popular audience, they must be omitted. Our only disagreements with the author center on choices of certain theories over others and the authoritative manner in which they are presented. The author states that things happened thus and so, even though the theory presented as fact is considered merely probable by a minority of the authorities on the subject. Perhaps this manner is necessary in a popular discussion of such wide scope, yet the reader is not made to appreciate the flux, balancing factors and unknowns among existing theories—the essence of scientific inquiry.

In the astronomical sections, where this reviewer is best qualified, I felt that the author was not sufficiently critical of the observational uncertainties underlying some of the hypotheses. To be specific, the resonance theory for the origin of the moon is presented as fact, even though Jeffreys has shown that the viscosity of the molten earth would have been so great that the resonance tide would have been but a low bulge on the earth and quite incapable of giving birth to the moon. Again, the lunar material is positively assigned an origin in the Pacific basin. Many scientists still shake their heads over this well-known hypothesis and point out that although it may be true, much more evidence must be collected before they will be convinced.

This reviewer was least satisfied with Chapter II, "The Blessed Event," detailing the origin of the planetary system according to the Jeans and Jeffreys tidal theory. The deficiencies of Laplace's nebular hypothesis are well stated, but the same deficiencies in the tidal theory are not mentioned. In **The Solar System and Its Origin** (1935), Prof. H. N. Russell has shown that the basic problem to be solved by any acceptable theory must account for the distribution of angular momentum between the planets and the sun; 98 per cent of this momentum is concentrated in the planets which contain only 1/700 of the total mass of the solar system. Prof. Gamow presents the Jeans-Jeffreys tidal theory as generally accepted fact. The astronomical novice reading this book will conclude that the mode by which the solar system originated is clearly known to all astronomers; the truth is, alas, quite the reverse.

Prof. Gamow writes with humor and a very readable style. His ability to carry discussions one step farther than is customary often results in surprising pictures of what would have been **if** something had been a little different. For factual matter the book presents a broad and unified picture composed of theories chosen from the multitudes being tested against observation. There are still some notes from the family bible, perhaps a will or two and a diary still buried in the geological basement; when these are unearthed some of the chapters in this biography will need revision.

FLETCHER G. WATSON
Harvard College Observatory

EARTH, MOON AND PLANETS

FRED L. WHIPPLE. The Blakiston Company, Philadelphia, 1941. 293 pages. $2.50.

THE STORY OF VARIABLE STARS

LEON CAMPBELL and LUIGI JACCHIA. The Blakiston Company, Philadelphia, 1941. 226 pages. $2.50.

AGAIN the Harvard books hold our attention. The two that have just appeared get the same acclaim from me as those reviewed in the October issue of The SKY.

Dr. Whipple's list of chapters shows that the subject matter is presented in unconventional order (the "Discoveries of Neptune and Pluto" is the third chapter in the book), but what he does with it is refreshing. All the old material and the familiar illustrations are included, plus a wealth of new information that makes the story complete and graphic.

Constant reference to the photographs, to illustrate specific points, makes them a part of the text, and not simply ornaments to relieve the pages. Original drawings with witty touches aid some discussions.

Amateurs and professionals alike will praise the author for including in Appendix V a means of locating the five naked-eye planets until 1970. Only a glance at the table, once one has learned to use it, will suffice to indicate very nearly the positions of the planets for any time in the next 30 years. For some this will be a well-worn part of the book before the last chapter, on the evolution of the system, is read.

I miss more precise descriptions of the sizes of satellites, and a mention of the fact that always amazes me: two satel-

lites of Jupiter are larger than Mercury. I miss, too, a tribute to the Greek philosophers who taught the rotundity, rotation, and revolution of the earth. But I am glad the author included this: "A simple law, if it fits the observations well, is almost always the true one in science."

In the controversial sections of the book (lunar craters, Martian phenomena), Dr. Whipple has gone to great lengths to include practically everything on both sides. As a matter of fact, his treatment of these topics will bring adherents of both sides to their feet with the charge of bias! He has leaned far, to satisfy everyone, and some of the things he says I know will surprise his readers.

Dr. Whipple has given Michigan's Lamont-Hussey Observatory at Bloemfontein to Yale, which already has a nice observatory at Johannesburg, and he has permitted us to see stars by day, if not from the bottom of a well, at least from the bottom of a chimney. He lets us see only a "glaring sun" by day on the moon, whereas the sky should be dark enough to permit stars to be observed, when the sun's direct light on the eye is shaded. Psychologists won't like his saying that a photon possesses color; a wave length of light produces a certain color sensation, but the light itself, as a wave or traveling impulse, is not colored.

This third of the Harvard series is an excellent book, well-written and illustrated. I heartily recommend it for every type of reader.

The Story of Variable Stars, by Campbell and Jacchia, could naturally be expected to have considerable authority, for the senior author has been since the beginning of things the official guiding spirit of the organized amateur variable-star observers in this country. Any expectation that Cepheids and other variables not specifically included in the program of the A.A.V.S.O. might be slighted is soon dashed, for a better popular exposition of some of the intricacies of these pulsating stars does not exist. It is true, though, that in the sections dealing with the red variables and the novae this book really gets into its stride.

There are, regrettably, some imperfect passages. On page 3, large magnification is implied to be required to see faint variables, and on page 17 it is suggested by way of illustration that a designation such as "Ross 389" would be the 389th variable in a list compiled by Ross, whereas it would be a proper motion star, and not a variable.

While the emphasis in this **Story of Variable Stars** is largely observational, the theories are not slighted, by any means. The difficult passages in the original theories are rewritten in such a way that they seem easy, but all sides of the picture are given, leading again to my belief that professional astronomers will get ideas from these books.

Throughout all the series, the wealth of fresh illustrative matter, both half-tones and diagrams, and the complete indices, will guarantee their constant use. I hope the other five volumes come hurrying along.

ROY K. MARSHALL
Fels Planetarium

NEW BOOKS RECEIVED

SCIENCE CALLS TO YOUTH, Raymond F. Yates. 1941, *Appleton-Century*. 205 pp. $2.00.

An interesting and sprightly book, designed for high school and college students who are planning scientific careers. Some of the dramatic scientific developments of recent years are presented. Mr. Yates discusses the value of specialization in various fields of science and the opportunities they offer.

METEOROLOGY, 2nd edition, *Donald S. Piston*. 1941, *Blakiston*. 233 pp. $3.00.

Primarily for a text for a semester course, this book is well-illustrated and well-diagrammed, and will provide home study for an interested amateur.

THE STORY OF VARIABLE STARS, *Leon Campbell and Luigi Jacchia*. 1941, *Blakiston*. 226 pp. $2.50.

Of particular interest to amateurs because of the contributions to astronomy which they can make in this field, *The Story of Variable Stars* adds another valuable book to the Harvard series.

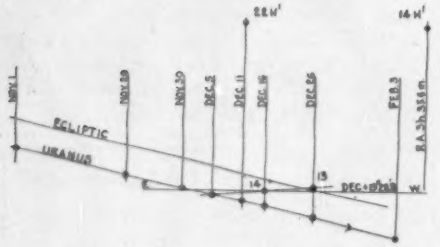
EARTH, MOON AND PLANETS, *Fred L. Whipple*. 1941, *Blakiston*. 293 pp. $2.50.

In this modern-styled exposition of the major bodies of the solar system, the sequence of subjects follows a dynamic, rather than a descriptive, order of presentation.

OBSERVER'S PAGE

By Jesse A. Fitzpatrick

THE PATH OF URANUS



The planet Uranus will be in retrograde motion throughout the balance of the year and will continue so until February 3, 1942. Its movements during that period will be in close proximity to a group of four stars in Taurus: 14, 13, 22 H¹, and 14 H¹, of magnitudes 6.3, 5.5, 6.0, and 6.4, respectively. The magnitude of Uranus will be 6.0 at opposition on the 20th. The four stars are included in an area slightly less than 1.5 degrees square. The center of the group lies four degrees south of and 1.5 degrees west of Alcyone, the brightest star in the Pleiades.

The planet's path will lie 13 minutes angular distance south of the ecliptic, and at the end of its retrograde motion on February 3rd, Uranus will be 12 minutes east of a possible conjunction with 14 H¹. As the planet moves eastward in its progressive motion after that date, it will be closer to the ecliptic, averaging about 11 minutes south for the balance of the winter and spring months.

On December 5th, it will be in alignment with the stars 14 and 13. The angular separation of the stars is 22 minutes, and on that date Uranus will be 24 minutes east of 14.

On the 11th, 16th, and 26th of December, it will be in conjunction with 22 H¹, 14, and 13, respectively, the distance from 14 being slightly less than eight minutes.

Binoculars are preferable to a telescope for these observations. The entire fall, winter, and spring movements can be seen in one field.

The **Leonid meteors** are due this month, reaching their maximum about the 16th, but they are not expected to be more than an ordinary shower. Observers may compare their results with those described in Dr. Kingsbury's letter on page 3.

PHASES OF THE MOON

Full moon	Nov. 3, 9:00 p.m.	(E.S.T.)
Last quarter	Nov. 11, 11:53 p.m.	
New moon	Nov. 18, 7:04 p.m.	
First quarter	Nov. 25, 12:52 p.m.	

MINIMA OF ALGOL

November 11	5:23 a.m.	(E.S.T.)
14	2:11 a.m.	
16	11:00 p.m.	
19	7:49 p.m.	

THE PLANETS IN NOVEMBER

Mercury will reach greatest elongation west, 19° 11′, in the morning of the 12th. The southerly declination, —9° 25′, will bring it too near the horizon to be of interest to mid-northern observers.

Venus will reach greatest eastern elongation, 47° 16′, at midnight E.S.T., November 22nd. The extreme southern declination, —25° 22′, will considerably reduce the period after sunset during which observers in the United States may appreciate the beauty of the planet.

Mars, gradually losing its October brilliancy, will be in Pisces. Its stellar magnitude at the end of the month will be —0.9. It will resume its progressive motion on the 12th.

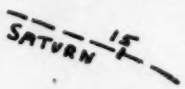
Jupiter, in retrograde motion, will remain in Taurus.

Saturn, in Taurus, is in retrograde motion and will be in opposition to the sun on November 17th, when it will be 756,300,000 miles from the earth.

Uranus. See special article and diagram.

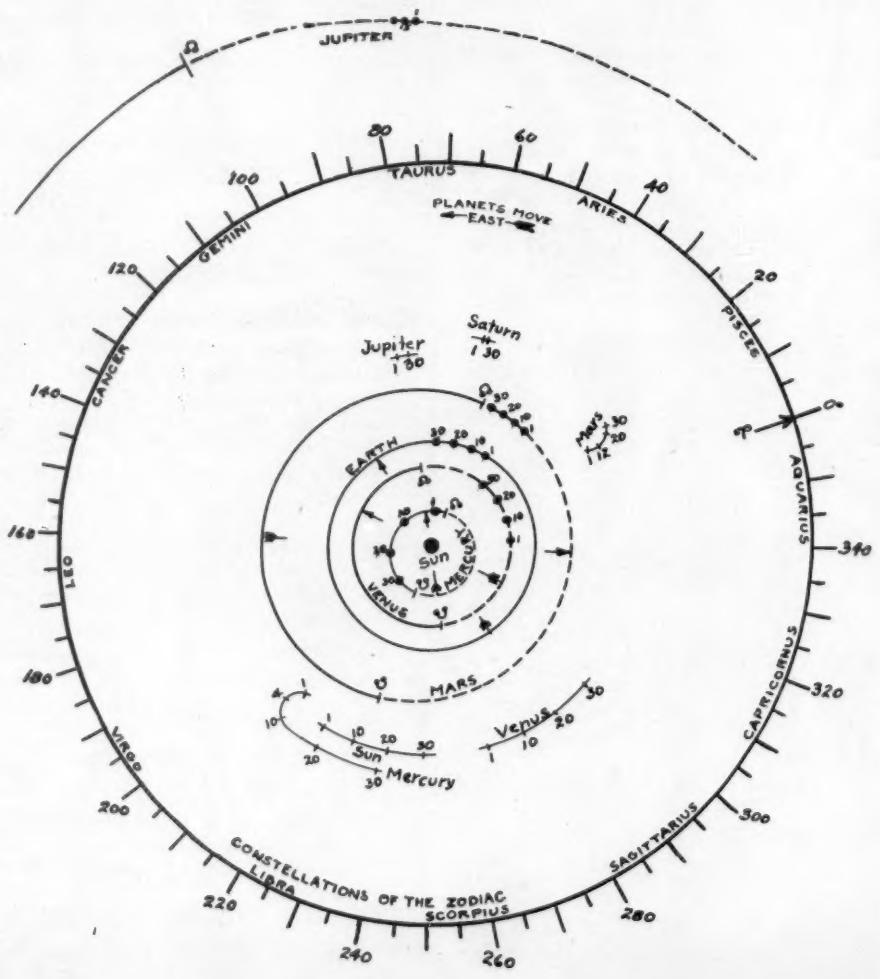
Neptune is in Virgo.

In the chart below, the orbits of the planets are drawn to scale, and on the orbits are



shown the heliocentric positions of the planets. Ascending and descending nodes are also marked by the usual symbols.

For convenience, *geocentric* positions are also shown. Suppose, instead of the sun, we had the earth at the center of the diagram. Then straight lines drawn from it through the short arcs just outside the Mars orbit show the positions of the planets against the zodiac at the various dates. Chart by Sylvan Harris from *The Amateur's Planetarium*.



ANSWERS TO DO YOU KNOW?

(*Questions on page* 19)

I. 1, a; 2, d; 3, a; 4, a; 5, a; 6, c; 7, a; 8, d; 9, b; 10, c.

II. 1. A telescope with a convex secondary mirror, which reflects the light through a hole in the primary mirror.

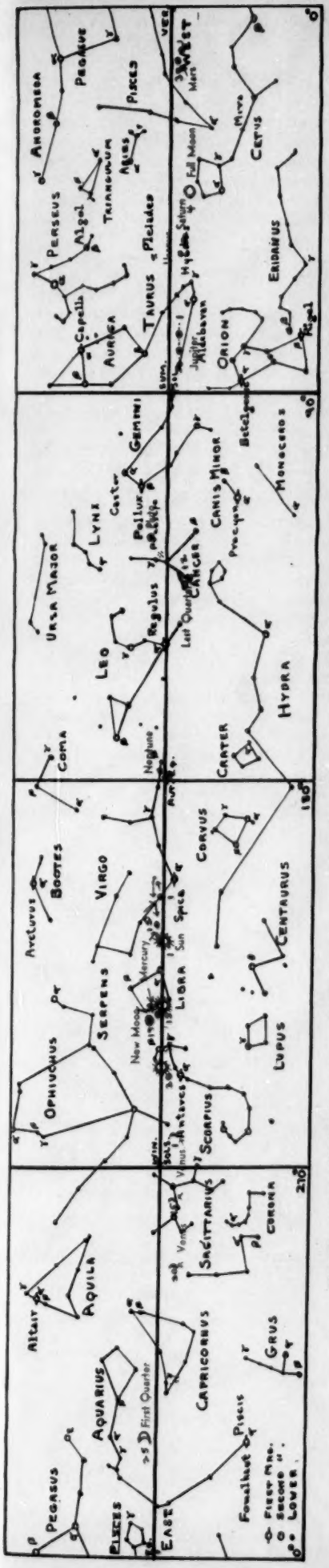
2. Yildun, Alcor, Al Rischa, Acubens, Thuban, Rotanev, and others.

3. The answer is 23 years. Eleven years is only a half-cycle.

III. 1. It is believed that Neptune once had two satellites, each revolving directly (west to east), and that as a result of their encounter, one became retrograde, the other the planet Pluto. (Variations in these sentences are possible, and such variations should be counted correct.)

2. Transits of Venus occur in pairs eight years apart, with an interval between pairs of over a century.

3. The giant expanding Crab nebula is now known to be the product of stellar disintegration resulting from the explosion of a supernova observed by the Chinese in 1054.



THE APPARENT POSITIONS IN THE HEAVENS OF THE SUN, MOON, AND PLANETS.

OCCULTATIONS—NOVEMBER, 1941

Local station—lat. 40° 48'.6, long. 4h 55.8m west.

Date	*Mag.*	*Name*	*Immersion* E.S.T.	*P.**	*Emersion* E.S.T.	*P.**
Nov. 5	3.9	γ Tauri	7:33.5 p.m.	142°	7:59.9 p.m.	189°
6	5.3	75 Tauri	0:50.1 a.m.	90°	2:21.3 a.m.	247°
6	6.5	275 B Tauri	5:04.3 a.m.	163°	5:21.7 a.m.	190°
6	1.1	Aldebaran	5:59.9 a.m.	105°	7:03.6 a.m.	250°
8	6.4	BD +18° 1112	2:23.9 a.m.	76°	3:55.0 a.m.	286°
8	5.7	124 H^1 Orionis	4:59.6 a.m.	125°	6:13.7 a.m.	251°
9	6.2	110 B Geminorum	2:44.2 a.m.	58°	3:59.3 a.m.	311°
12	5.1	ξ Leonis	0:38.5 a.m.	157°	1:12.7 a.m.	223°
21	6.4	BD —19° 5182	6:46.4 p.m.	138°	7:19.7 p.m.	204°
24	5.4	λ Capricorni	9:45.3 p.m.	15°	10:22.9 p.m.	302°
25	6.4	167 G Aquarii	9:53.8 p.m.	66°	11:00.6 p.m.	246°
30	6.5	25 Arietis	5:27.8 p.m.	9°	6:04.6 p.m.	308°

*P is the position angle of the point of contact on the moon's disk measured eastward from the north point.

THE MOON IN THE HYADES

When the moon passes through this V-shaped group of stars on November 5-6, there will be fewer occultations than on August 16th, but an observer will be able to see the moon travel the entire length of the V between the hours of early evening on the 5th and dawn the following morning. The occultation of the star γ Tauri, at the point of the V, will commence at 7:33.5 p.m. E.S.T., at our local station, and the occultation of Aldebaran, at the easterly end of the southern leg of the V, will start a few seconds before 6:00 a.m. It will take the moon 10.5 hours to cover this distance—almost exactly four degrees.

Of particular interest will be the short occultations of γ and 275 B Tauri. At the moment of conjunction in right ascension of the star and the moon's axis, γ will be only three per cent of the moon's diameter above the southern edge. 275 B will be still closer, only one per cent above the southern edge.

During this passage, four stars will be in sufficiently close conjunction to be of interest and all will be south of the moon. The moment of conjunction, the distance south of the moon's edge in percentage of the moon's diameter, and the position angle of the moon's axis are as follows:

	Nov.		%	P.A.
70 Tauri	5	11:30.8 p.m.	12.5	349°
θ^1 Tauri	6	1:44.3 a.m.	43	350°
θ^2 Tauri	6	1:48.4 a.m.	62.5	350°
264 B Tauri	6	3:12.8 a.m.	12	350°

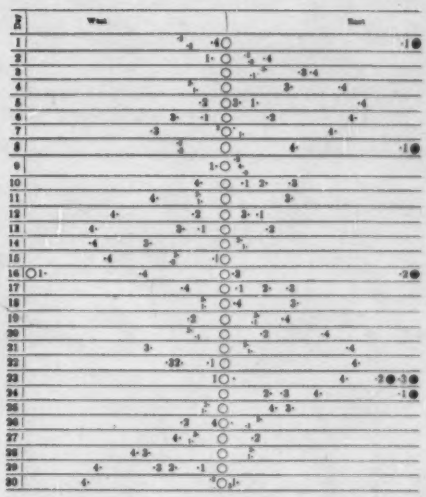
When the moon is in perigee on November 18th, it will be 221,700 miles from the earth, unusually close. As this is also the time of new moon, we can expect exceptionally high tides on that and the following days.

THE ECLIPTIC CHART

at the left is drawn with the ecliptic as its central line, instead of the celestial equator. Perpendicular to this are lines marking celestial longitude. The positions of the sun, moon, and inner planets are shown for the beginning, middle, and end of the month. The outer planets do not change materially from the positions shown during that time. On the next page is the star chart for this month.

JUPITER'S SATELLITES

Jupiter's four bright moons have the positions shown below at 1:45 a.m. E.S.T. The motion of each satellite is from the dot to the number designating it. Transits of satellites over Jupiter's disk are shown by open circles at the left, and eclipses and occultations by black disks at the right. From the **American Ephemeris.**



On November 2nd, after 8:47 p.m. E.S.T., and on the 24th, after 2:02 a.m., all of the bright satellites will be east of Jupiter and in numerical order, I being nearest the primary. On the 28th during the entire evening, the four will be on the west side in numerical order, with I nearest the planet.

On November 17th, at 9:17.5 p.m. E.S.T., moon **IV** will be in superior geocentric conjunction, appearing at that moment just north of the edge of the disk.

I am indebted to Charles E. Apgar, Westfield, N. J., for calling to my attention two occasions in November when Jupiter will appear to be attended by only one bright satellite, moon **IV**. On the 23rd, this will happen between the hours of 2:38 a.m. E.S.T. and 3:54 a.m., and on the 30th between 4:21 a.m. and 6:31. In the latter period the satellite will be at its greatest elongation west and in a telescope with small field, Jupiter will appear as a planet without moons.

On November 17th and 24th, the shadows of moons I and II will simultaneously be in transit across the face of the disk, on the former date between 6:48 p.m. E.S.T. and 7:55 p.m., and in the second case between 8:42 and 10:32 p.m. E.S.T.

BIOGRAPHY

(*Continued from page 7*)

Amateur Astronomers Association, will serve as Associate Editors."

In the November number of the magazine this announcement appeared: "With this first issue of The SKY, the *Amateur Astronomer* takes its bow and disappears backstage. Although as a separate entity it is gone, it is still not forgotten, for between the covers of The SKY it lives on in spirit and reality."

Under Mr. Adamson's able editorship, the new monthly grew in reputation and circulation. Various regular monthly departments were developed in addition to those devoted to the Junior and Amateur Astronomers. Each month William H. Barton, Jr., has written The Drama of the Skies, the story of the current presentation in the Hayden Planetarium. The other members of the Planetarium staff contributed regularly to the magazine, and outsiders were most generous in their aid.

Gradually other members of the staff became associated with The SKY—Helene C. Booth as assistant editor in October, 1937; Mr. Barton as associate editor, and Charles A. Federer, Jr., as assistant editor in November of that year.

In February, 1938, Dr. Clyde Fisher, curator-in-chief of the Hayden Planetarium, became editor of The SKY, ably assisted by Miss Booth, Miss Bennett, and Charles E. Powers. Later, however, the Planetarium was unable to continue financial support of the magazine, and on November 1, 1939, it passed into the management of Charles and Helen Federer, who became both editors and publishers, maintaining their offices in the Planetarium. Under their guidance, The SKY concluded its fifth volume, only to find new horizons as a partner in the combination, *Sky and Telescope*.

MARIAN LOCKWOOD

NEW ACTING DIRECTOR AT ALLEGHENY

Dr. Nicholas E. Wagman has been appointed acting director of Allegheny Observatory, succeeding the late Dr. Frank C. Jordan, according to a recent announcement of the University of Pittsburgh.

Previously on the staff of the Naval Observatory, Dr. Wagman has been at Allegheny since 1930, and has lectured at the Buhl Planetarium since its opening.

AMATEUR ASTRONOMERS ASSOCIATION

The A.A.A. lecture season continues with a talk on November 5th by Dr. Fred L. Whipple, of Harvard Observatory, entitled **The Meteor Speedometer.** Free guest tickets are available on request for all lecture meetings, which are held at 8:15 p.m., in the Lecture Hall, Roosevelt Memorial Building, American Museum of Natural History, New York City.

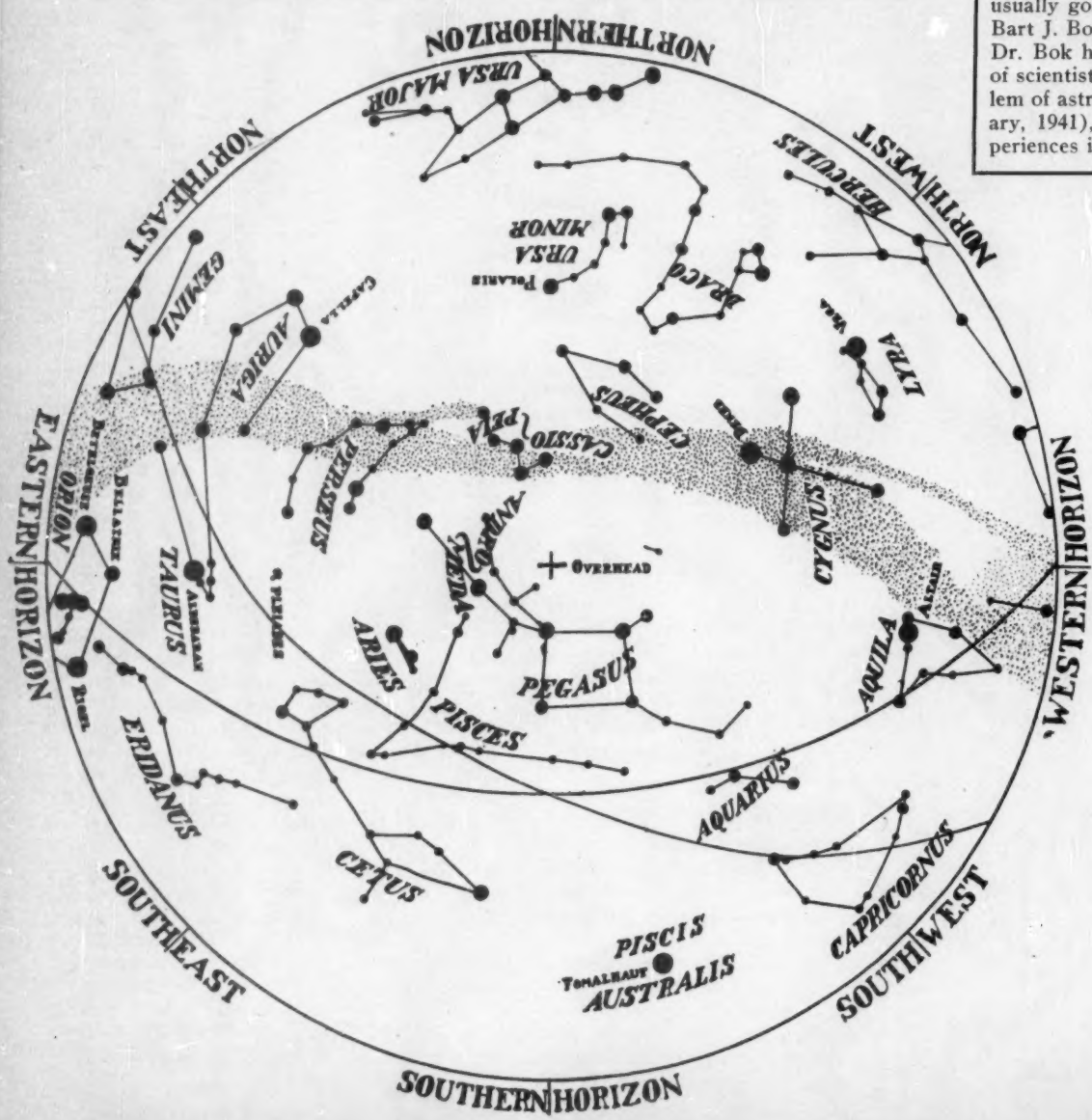
On November 19th, Donald H. Kimball, of the New Haven Amateur Astronomical Society, will speak on **Variable Stars With a Photoelectric Photometer.** On December 3rd, **An Amateur's Observatory** will be the subject of a lecture before the A.A.A. by Paul S. Watson, Maryland Academy of Sciences.

Arrangements have been made for a visit by A.A.A. members and friends to Columbia University Observatory on the evening of Armistice Day.

JUNIOR ASTRONOMY CLUB

On Saturday evening, November 8th, Albert R. Luechinger, president of the Long Island Astronomical Society, speaks to the Club on **Amateur Astronomical Photography.**

The Club's previously-announced program for November 22nd has been changed, because we have had the unusually good fortune of persuading Dr. Bart J. Bok, of Harvard, to speak then. Dr. Bok has been the head of a group of scientists who are studying the problem of astrology (see The SKY, February, 1941), and will talk about his experiences in this connection.



THE STARS FOR NOVEMBER

as seen from mid-northern latitudes at 9 p.m., November 7th; 8 p.m., November 23rd. Magnitudes of the stars are indicated by the sizes of the disks marking the stars, and the names of those of the 1st-magnitude are shown. The ecliptic and the equator are shown, the latter touching the horizon at the east and west points. See chart on the Observer's Page for the positions of the sun, moon, and planets as seen this month.

HERE AND THERE WITH AMATEURS

This is not intended as a complete list of societies, but rather to serve as a guide for persons near these centers, and to provide information for traveling amateurs who may wish to visit other groups.

City	*Organization*	*Date*	*Hour*	*Season*	*Meeting Place*	*Communicate with*
BOSTON	BOND AST. CLUB	1st Thu.	8:15 p.m.	Oct.-June	Harvard Observatory	Homer D. Ricker, Harvard Observatory
"	A.T.M.S OF BOSTON	2nd Thu.	8:15 p.m.	Sept.-June	Harvard Observatory	E. R. Lacy, Harvard Observatory
BROOKLYN, N. Y.	ASTR. DEPT., B'KLYN INST.	Round Table 3rd Thu.	8:00 p.m.	Oct.-April	Brooklyn Institute	William Henry, 154 Nassau St., N. Y. C., *BA.* 7-9473
BUFFALO	A.T.M.S & OBSERVERS	1st & 3rd Fri.	8:00 p.m.	Oct.-June	Museum of Science	J. J. Davis, Museum of Science
CHATTANOOGA	BARNARD A. S.	4th Fri.	7:30 p.m.	All year	Chattanooga Obs.	C. T. Jones, 1220 James Bldg., *CHat.* 6-8341
CHICAGO	BURNHAM A. S.	2nd & 4th Tue.	8:00 p.m.	Sept.-June	Congress Hotel	Wm. Callum, 1435 Winona Ave.
CLEVELAND	CLEVELAND A. S.	Fri.	8:00 p.m.	Sept.-June	Warner & Swasey Obs.	Mrs. Royce Parkin, The Cleveland Club
DETROIT	DETROIT A. S	2nd Sun.	3:00 p.m.	Sept.-June	Wayne U., Rm. 187	E. R. Phelps, Wayne University
"	NORTHWEST A. A. S.	1st & 3rd Tue.	8:00 p.m.	Sept.-June	Redford High Sch.	L. H. Sprinkle, R. 2, Farmington
FT. WORTH	TEX.. OBSERVERS	No reg. meetings	.....			Oscar E. Monnig, 1010 Morningside Dr.
GADSDEN, ALA.	ALA. A. A.	1st Thu.	7:30 p.m.	All year	Ala. Power Auditorium	Brent L. Harrell,1176 *W* or 55
INDIANAPOLIS	INDIANA A. A.	1st Sun.	2:00 p.m.	All year	Central Library Audit.	E. W. Johnson, 808 Peoples Bank Bldg.
LOS ANGELES	L. A. A. S.	2nd Thu.	8:15 p.m.	.....	2606 W. 8th St.	Charles Ross, 2606 W. 8th St.
LOUISVILLE, KY.	L'VILLE A. S.	3rd Tue.	8:00 p.m.	Sept.-May	Women's Bldg., Univ. of Louisville	Mary Eberhard, 3-102 Crescent Ct., *Taylor* 4157
MADISON, WIS.	MAD. A. S.	2nd Wed.	8:00 p.m.	All year	Washburn Observatory	C. M. Huffer, Univ. of Wisconsin
MILWAUKEE	MILW. A. S.	1st Thu.	8:00 p.m.	Oct.-May	U. of Wis., Ext. Div.	C. M. Prinslow, *Bl.* 4039
MOLINE, ILL.	POP. AST. CLUB	2nd Tue.	7:30 p.m.	All year	Sky Ridge Observatory	Carl H. Gamble, Route 1
NEW HAVEN	NEW HAVEN A. A. S.	1st Sat.	8:00 p.m.	Sept.-June	Yale Observatory	F. R. Burnham, 820 Townsend Ave., 4-2618
NEW YORK	A. A. A.	1st & 3rd Wed.	8:15 p.m.	Oct.-May	Amer. Mus. Nat. Hist.	G. V. Plachy, Hayden Plan., *EN.* 2-8500
" "	JUNIOR AST. CLUB	Alternate Sat.	8:00 p.m.	Oct.-May	Amer. Mus. Nat. Hist.	J. B. Rothschild, Hayden Plan., *EN.* 2-8500
OAKLAND, CAL.	EASTBAY A. A.	1st Sat.	8:00 p.m.	Sept.-June	Chabot Observatory	Miss H. E. Neall, 6557 Whitney St.
PHILADELPHIA	A.A. OF F.I.	3rd Fri.	8:00 p.m.	All year	The Franklin Institute	Edwin F. Bailey, *Rit.* 3050
"	RITTENHOUSE A. S.	2nd Fri.	8:00 p.m.	Oct.-May	The Franklin Institute	A. C. Schock, *Rit.* 3050
PITTSBURGH	A. A. A. OF P'BURGH	2nd Fri.	8:00 p.m.	Sept.-June	Buhl Planetarium	F. M. Garland,1006 Davis Ave., N.S.
PORTLAND, ME.	A. S. OF MAINE	2nd Fri.	8:00 p.m.	All year	Private Homes	H. M. Harris, 27 Victory Ave., S. Portland
PROVIDENCE, R. I.	SKYSCRAPERS	1st Wed.	8:00 p.m.	All year	Wilson Hall, Brown U.	Ladd Obs., Brown U., *GA.* 1633
READING, PA.	READING-BERKS A. C.	2nd Thu.	8:00 p.m.	Sept.-June	Albright College	Mrs. F. P. Babb, 2708 Filbert Ave.
RENO, NEV.	A. S. OF NEV.	4th Wed.	.....	All year	Univ. of Nevada	G. B. Blair, University of Nevada
ROCHESTER, N. Y.	ROCH. AST. CLUB	Alt. Fri.	8:00 p.m.	Oct.-May	Eastman Bldg., Univ. of Rochester	P. W. Stevens, 1179 Lake Ave., *Glenwood* 5233-*R*
SAN ANTONIO	SAN ANT. A. A.	3rd Mon.	8:00 p.m.	All year	Le Villela	R. B. Poage, 807 Hammond Ave.
SCHENECTADY	S'TADY AST. CLUB	3rd Mon.	8:00 p.m.	All year	Observatory site	C. H. Chapman, 216 Glen Ave., Scotia
TACOMA, WASH.	TACOMA A. A.	1st Mon.	.....	All year	Coll. of Puget Sound	Geo. Croston, *Gar.* 4124
WASHINGTON, D. C.	NAT'L. CAP. A. A. A.	1st Sat.	8:00 p.m.	Oct.-June	U. S. Nat'l. Museum	Stephen Nagy, 104 C St., N.E.,*Linc.* 9487-J
WICHITA, KANS.	WICHITA A. S.	2nd Tue.	8:00 p.m.	All year	East High Sch., Rm. 214	S. S. Whitehead, 2322 E. Douglas, 33148

Sky and Telescope is official publication of many of these societies.

★ ★

PLANETARIUM NOTES

Sky and Telescope is official bulletin of the Hayden Planetarium in New York City and of the Buhl Planetarium in Pittsburgh, Pa.

★ **THE BUHL PLANETARIUM** presents in *November,* "FREEDOM OF THE SKIES."

The Buhl Planetarium presents, beginning November 7th, "Freedom of the Skies." This vital and timely story of national defense—and especially defense in the air—is the theme of the Buhl Planetarium's November sky show. The important role of the stars and other heavenly bodies in guiding the aviator over land and sea is first presented graphically to visitors, the basic elements of celestial navigation in wartime. Then, with the airplane itself entering the Planetarium sky, there follows by means of specially constructed gadgets the realistic bombing of a great city of today, exemplifying the coordination of all resources essential to successful defense in modern all-out war. Giant bombers drone overhead in mass formation, swift fighter planes engage in combat, searchlights sweep the sky, anti-aircraft guns spring into action as the invader releases his hordes of parachute troops. Unforgettably is shown the need of split-second cooperation between all defense units in the modern defense of freedom.

★ **THE HAYDEN PLANETARIUM** presents in *November,* MYSTERIOUS MARS. (See page 11.)

In *December,* CHRISTMAS SHOW. The Christmas show at the Planetarium remains one of the prime favorites of the year. The identity of the Star of Bethlehem will probably never cease to be a mystery, but in the Planetarium this month various answers to that mystery are suggested. You will find yourself, having broken the bonds of time, seated beneath the stars of 2,000 years ago, watching the heavens of 6 and 7 B.C., and drawing your own conclusions about that first Christmas star.

★ SCHEDULE BUHL PLANETARIUM

Mondays through Fridays ..... 3, 8, and 9 p.m.
Saturdays ..... 2, 3, 8, and 9 p.m.
Sundays and Holidays ..... 3, 4, 8, and 9 p.m.

★ STAFF—*Director,* Arthur L. Draper; *Lecturers,* O. P. Keeney, Nicholas E. Wagman; *Business Manager,* Frank S. McGary; *Public Relations,* John J. Grove; *Curator of Exhibits,* Fitz-Hugh Marshall, Jr.

★ SCHEDULE HAYDEN PLANETARIUM

Mondays through Fridays ..... 2, 3:30, and 8:30 p.m.
Saturdays ..... 11 a.m., 2, 3, 4, 5, and 8:30 p.m.
Sundays—Mutual Network Broadcast—Coast-to-Coast ... 9:30-10:00 a.m.
Sundays and Holidays ..... 2, 3, 4, 5, and 8:30 p.m.

★ STAFF—*Honorary Curator,* Clyde Fisher; *Curator,* William H. Barton, Jr.; *Assistant Curators,* Marian Lockwood, Robert R. Coles.

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